FINAL DRAFT
SITE INSPECTION REPORT
UNION CHEMICAL
CARTERET, NEW JERSEY

PREPARED UNDER

TECHNICAL DIRECTIVE DOCUMENT NO. 02-8804-09
CONTRACT NO. 68-01-7346

FOR THE

ENVIRONMENTAL SERVICES DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

**JUNE 27, 1989** 

NUS CORPORATION
SUPERFUND DIVISION

SUBMITTED BY

DIANE TRUBE
PROJECT MANAGER

GLENN A. CALABRESE SITE MANAGER REVIEWED/APPROVED BY

RONALD M. NAMAN

**FIT OFFICE MANAGER** 

02-8804-09-SI Rev. No. 0

SITE NAME: ADDRESS:

Union Chemical 350 Roosevelt Avenue Carteret, New Jersey

EPA ID NO: LATITUDE: NJD063173280 40° 34′ 42″ N 74° 12′ 53″ W

LONGITUDE: BLOCK:

6.01

LOT: ACREAGE:

4.436

### 1.0 SITE SUMMARY

The Union Chemical Company is located on approximately 4.4 acres of land in Carteret Borough, Middlesex County, New Jersey. The facility is active and is in a heavily industrialized section of Carteret. The site is bounded by Noes Creek to the south, Roosevelt Avenue to the east, New Jersey Branch Railroad tracks to the west, and the Wheeler Condenser and Engineering Company to the north. The facility is owned and operated by Union Oil Company of California, aka American Mineral Spirits Company. The Benjamin Moore Company owned the property and operated there until 1962 when Union Chemical purchased the facility for bulk storage and repackaging. From 1969 to 1984, anhydrous ammonia was processed to ammonia. Presently, approximately 125 different products are handled at the facility, most of which are solvents.

The Union Chemical facility has had several spill releases to the environment since 1983. In June 1985, IT Corporation was retained by Union Chemical to conduct a site assessment. The purpose of this initial site assessment was to define the geologic and hydrogeologic conditions and to estimate the extent of possible groundwater contamination at the site. IT Corporation installed 18 monitoring wells on site, which are presently being tested quarterly by Union Chemical.

In 1988, Woodward-Clyde consultants were procured by Union Chemical Company to assist in the evaluation of a 1988 spill and to further assess the environmental conditions at the site. The Union Chemical owners have submitted a plan to the State for removal of contaminated soil. The plan is awaiting final approval.

An on-site reconnaissance was performed on March 7, 1989, by NUS Corp. Region 2 FIT. No sampling was performed by NUS Region 2 FIT since there are extensive data available.

Ref. Nos. 1, 2, 3, 4, 5, 6, 7, 9, 10, 14

### 2.0 SITE INSPECTION NARRATIVE

### 2.1 EXISTING ANALYTICAL DATA

This section will be divided into subsections, to present analytical data for each affected medium separately.

#### 2.1.1 Groundwater

The groundwater data are from the quarterly testing of the wells by Union Chemical as directed by the State in January 1989. Refer to Figures A and B for the sample location map prepared by Woodward-Clyde and groundwater contour map prepared by IT Corporation. Table A summarizes relevant data.

Ref. Nos. 9, 11

#### 2.1.2 Surface Water

Surface water samples were collected by IT Corporation in December 1986. One water sample was reportedly collected upstream (SW-1) and two downstream (SW-2 and a duplicate) of the site from Noes Creek. Noes Creek is tidal. Although sampling was conducted at ebb tide, apparently with the assumption that such conditions permitted an upgradient sample unaffected by the site, it has not been documented satisfactorily that such effects as eddy currents and re-entrainment of contaminated sediment can be discounted.

<u>Parameter</u>	<u>SW-1</u> (values in ppb)	<u>SW-2</u> (values in ppb)	SW-2 (duplicate) (values in ppb)
benzene	6.6		
chlorobenzene	61	12	24
1,2-dichloropropane	200	98	83
ethylbenzene	9.1		
tetrachloroethylene	12	6.2	7.6
toluene	14	13	12
1,1,1-trichloroethane	12	11	14
acetone	18	***	
4-methyl-2-pentanone	41	14	14
total xylenes	80	19	27
methylene chloride		140	110

Ref. Nos. 11, 14

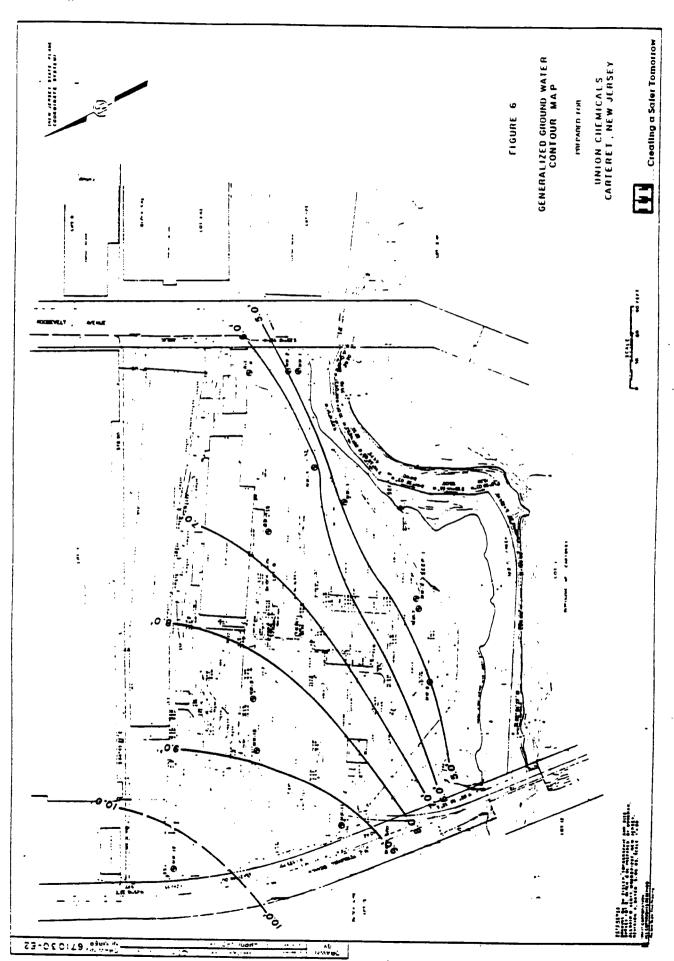


Figure A

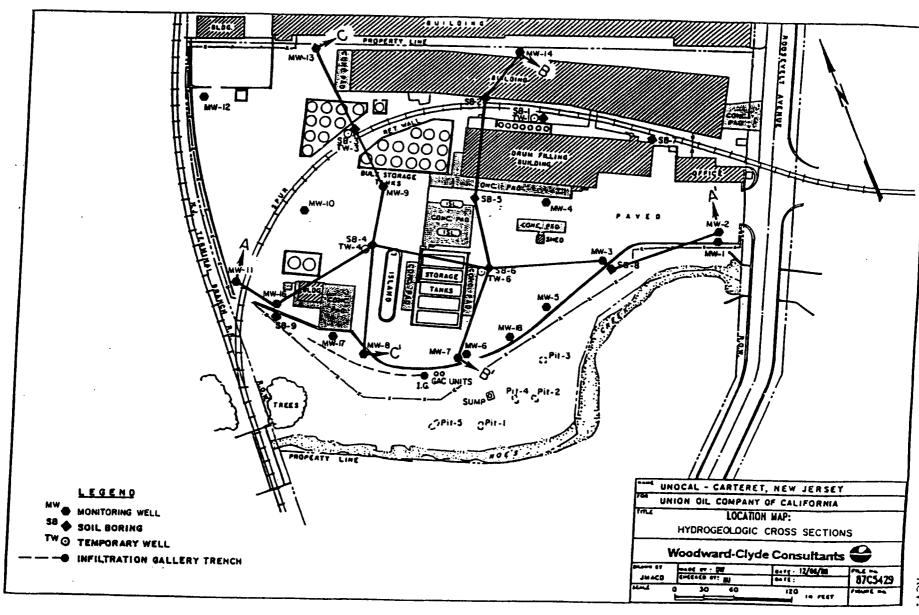


Figure B

# **TABLE A - SUMMARY OF GROUNDWATER MONITORING DATA**

Well No.	MW-10	<u>Upc</u> МW-11	radient Well MW-12	<u>s</u> MW-13	MW-14		wngradient MW-7	
Parameter				10100 13	10140-1-4	10100-0	10100-7	<u>MW-8</u>
	7.5							
benzene	75			3.8	6.2		1200	9400
chlorobenzene	91	1.4				8000	50	11000
ethyl benzene			24		4.3	-		
1,1 dichloroethylene							29000	
1,1 dichloroethane				1.2			4800	
1,2 dichloroethane							13000	
toluene	547						4500	
total xylenes					1.0	930		
methylene chloride						1100	48	570
1,1,1 trichloroethane				9.6		3200		
acrolein							500	
chloroethane	8.1							
bromoform			1.0					

Notes: a All data are in parts per billion.

Data are from Reference Number 9, Quarterly Sampling Results, January 1989 by Woodward-Clyde Consultants. Blank space indicates that parameter was not found above detection limits. b

C

#### 2.1.3 Soil

Nine soil borings were drilled and five tests pits were dug on site. Their locations are shown on Figure A. Available descriptions of samples collected are incomplete, as are sample depths and analytical data. However, the following data were available:

During excavation of test pits, IT Corporation noted stained soil and free product seeping from the soil at the water table in several pits. Water and soil samples from the test pits showed high concentrations of benzene, toluene, and total xylenes.

Soil samples from soil borings drilled by Woodward-Clyde Consultants are not described adequately and sample depths are unknown; however, high levels of chlorobenzene, methylene chloride, and ethylbenzene were noted in four borings.

There are no critical habitats with one mile of the site. Gateway National Recreation Area is just over one mile east of the site.

Ref. Nos. 2, 3, 11, 14

### 2.2 WASTE SOURCE DESCRIPTION

The Union Chemical facility has had several spill releases to the environment since 1983. The first spill occurred on February 17, 1983, when approximately 1860 gallons of methyl ethyl ketone (MEK), petroleum naphthalene, and propyl alcohol leaked into Noes Creek and into the subsurface soils. This was the result of an underground pipeline rupture. The pipeline led to an aboveground vertical storage tank (No. 7). The contaminated soil has not been removed as of this writing. Plans for the removal of the contaminated soil are awaiting final approval by the State. The second spill occurred on July 1, 1985, when approximately 500 gallons of xylene leaked into the groundwater. Any contamination of Noes Creek by this spill is unknown. An underground transit line pipe ruptured as it was being fed from the aboveground vertical storage tank (No. 7). Union Chemical was able to recover most of the spill from the groundwater. The third spill occurred in February of 1988, when an aboveground pipe from a vertical storage tank ruptured, releasing 15,000 gallons of 1,1,1-trichloroethane onto the ground. Most of the spill accumulated in a building basement (Drum Filling Building). The 1,1,1-trichloroethane was pumped out of the basement and was recovered. The contaminated soil was removed to a depth of about 3 feet, until a clay layer was reached. A total of 17,360 gallons of waste was spilled. Specific locations of each of these spills are not known.

Ref. Nos. 1, 2, 13

#### 2.3 GROUNDWATER ROUTE

The Union Chemical Site is located near the contact of the northwestward-sloping bedrock of the Traissic Lowlands and the overlying, southeastward-sloping unconsolidated deposits of the Coastal Plain. The bedrock consists of the Brunswick Formation shale, siltstone, and sandstone, occasionally interrupted by basaltic lava flows and diabase intrusions. The major diabase sill is approximately 1,000 feet thick. It forms the Palisades along the Hudson River, 1.5 miles east of the Union Chemical Site. The Coastal Plain deposits are the Raritan Formation of late Cretaceous Age, consisting of light-colored alternating sands, clays, and gravels, with interbedded marine sediments and peat. These deposits change locally in thickness because they were deposited on the irregular surface of Triassic bedrock. The Brunswick Formation underlies the entire area. Glacial drift of the Wisconsin glacial period was deposited over the bedrock and Coastal Plain material. The site is located in a 100-year floodplain.

On the site, glacial drift has been removed and replaced by fill deposits ranging in thickness up to at least 15 feet. The fill is composed of fine to coarse sands with some gravels, clay, bricks, concrete, metal, glass, and slag. These materials have low to moderate hydraulic conductivities, ranging from  $10^{-3}$  to  $10^{-5}$  cm/sec. Groundwater flows from north to south across the site. Depth to groundwater varies from 5 feet from ground surface at the southeast edge of the property near Noes Creek, to 10 feet at the northeast edge of the property.

The aquifer of concern includes the unconsolidated material of the Raritan Formation, extending downward to the top of the Raritan Fire Clay, a member of the Raritan Formation. The Raritan Fire Clay acts as a confining unit, hydraulically separating the rest of the Raritan Formation from the underlying Brunswick Formation Aquifer. There is another clay layer within the Raritan Formation; however, there appears to have been vertical leakage of contaminants through this clay layer. This was suggested by the increase in contaminant levels in deeper wells downgradient of waste sources. Additional sampling and later reports by IT Corporation suggested that the leakage may not be as great as first thought. Permeability of this clay is about 10-8 cm/sec. For the purposes of this report the aquifer of concern will remain as extending from the water table to the top of the Raritan Fire Clay.

Several sampling events have shown that there is, and continues to be, observed release of contaminants to groundwater. IT Corporation noted free product in three downgradient monitoring wells following a 1985 emergency response to seepage of product into Noes Creek. Free product was also observed flowing into test pits at the water table. Most recently, quarterly sampling of monitoring wells conducted in January 1989 by Unocal Chemicals (see Section 2.1.1) shows significantly higher concentrations of volatile organic compounds in wells downgradient of the site. These compounds include benzene, chlorobenzene, 1,1-dichloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, and toluene.

No part of the population utilizes groundwater within the 3-mile radius of the site. The Middlesex Water Company supplies potable water to the entire area from the Raritan River. There are no private wells in the area. The 3-mile radius of the site includes portions of the cities of Rahway and Linden, the borough of Carteret, the township of Woodbridge, and parts of Staten Island.

The annual net precipitation is 11 inches in the area. Only one industrial well is known to exist within the 3-mile radius of the site. This well taps the Brunswick Formation and is located less than one-quarter mile from the site.

Ref. Nos. 1, 2, 3, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18

#### 2.4 SURFACE WATER ROUTE

There is no observed release documented. Noes Creek is a tributary of Arthur Kill that parallels the site to the south. The site is less than 1000 feet west of the Arthur Kill. The area slopes approximately 3 to 5 percent in a southerly direction toward the creek. Noes Creek empties into the Arthur Kill, which eventually empties into the Raritan Bay. No critical habitats of federally endangered species exist within 1 mile. The 1-year 24 hour rainfall is between 2.5 and 3 inches.

There is no known use of these surface waters for drinking. Arthur Kill is not approved for swimming purposes. Though fishing is permitted, Health Department officials say that fishermen eat the fish at their own risk. No other recreational activities are reported for the Arthur Kill. Raritan Bay and many of Arthur Kill's tributaries have similar restrictions. The Island of the Meadows is 2,000 feet southeast of the site. There are tidal flats within 0.25 mile of the site. Noes Creek is a tidally influenced creek that is adjacent to the site. Two surface water samples were collected on June 6, 1986 from Noes Creek. Both samples were collected simultaneously during ebb tide. The locations of the samples, SW-1 and SW-2, were chosen to represent conditions just upstream (west) and just downstream (east), respectively, of the site. The locations were chosen such that during ebb tide it

was expected that the quality of the water flowing to location SW-1 would not be influenced by the site and, conversely, the quality of water flowing to the location SW-2 would be influenced by the site. Since it is not documented that such effects as eddy currents and re-entrainment of contaminated sediment can be discounted, these data cannot be used to document an observed release. Based on reports of spills and seeps into Noes Creek, however, further study may be able to document a release.

Ref. Nos. 10, 11, 12, 19, 20

#### 2.5 AIR ROUTE

No readings above background were detected in the ambient air on the OVA or HNu during the onsite reconnaissance conducted on March 7, 1989.

There are no historic landmarks within view of the site.

Ref. Nos. 2, 21

#### 2.6 ACTUAL HAZARDOUS CONDITIONS

There is evidence of an observed release which contaminated groundwater at the facility. The groundwater on site contained high concentrations of volatile organic compounds. There is a strong potential for contamination of surface and subsurface soil and Noes Creek.

No other actual hazardous conditions pertaining to human or environmental contamination have been documented. Specifically:

- Contamination has not been documented either in organisms in a food chain leading to humans or in organisms directly consumed by humans.
- There have been no documented observed incidents of direct physical contact with hazardous substances at the facility involving a human being (not including occupational exposure) or a domestic animal.
- There have been no documented incidents of damage to flora (e.g., stressed vegetation) or to fauna (e.g., fish kill) that can be attributed to the hazardous material at the facility.
- There is no documented contamination of a sewer or storm drain.

### 3.0 MAPS AND PHOTOS

# UNION CHEMICAL CARTERET, NEW JERSEY

# **CONTENTS**

Figure 1: Location of Hydrogeologic cross sections

Figure 2: Site Map

Figure 2A: Site Location Map

Figure 3: Hydrogeologic cross section A-A'
Figure 4: Hydrogeologic cross section B-B'
Figure 5: Hydrogeologic cross section C-C'
Figure 6: Plume area of shallow aquifer

Exhibit A: Photograph Log

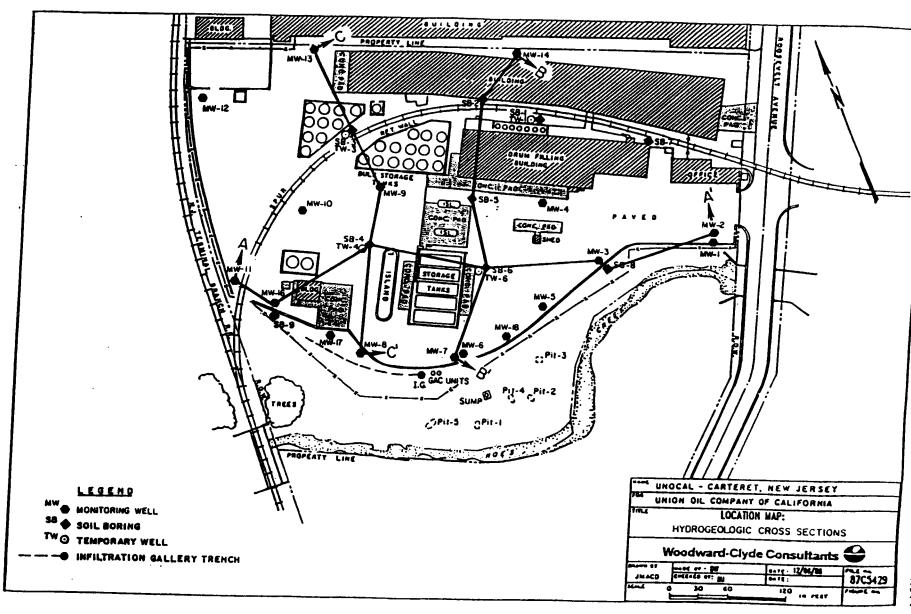
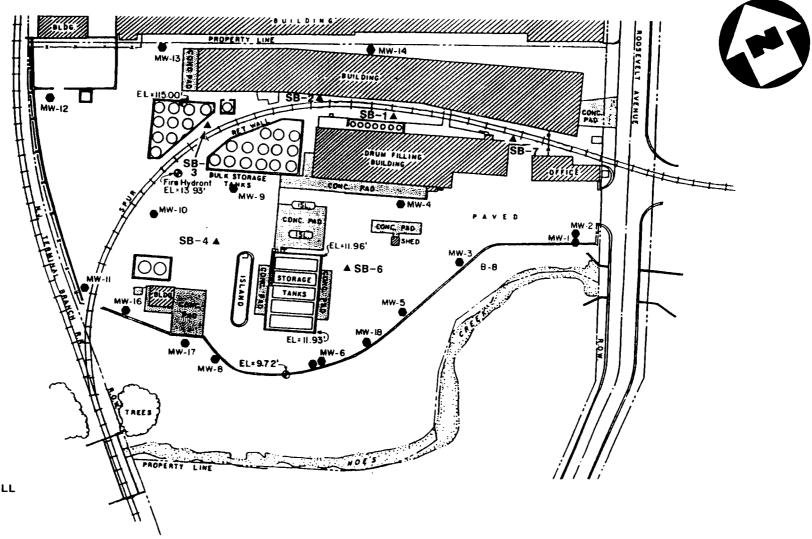


Figure (



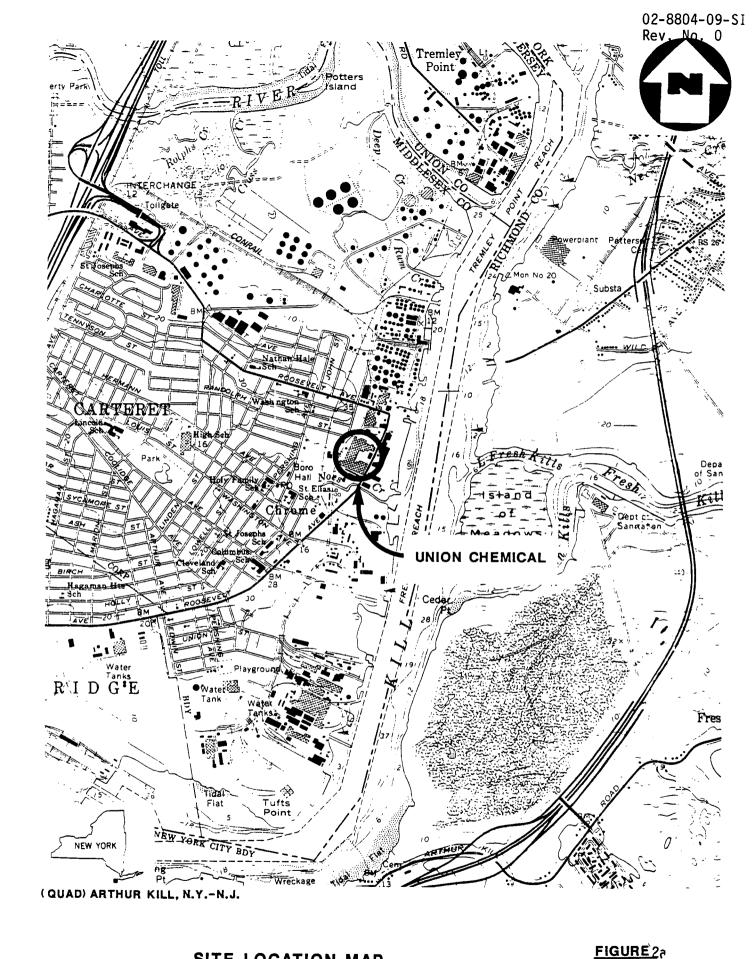
### LEGEND

- MONITORING WELL
- ▲ SOIL BORING

# SITE MAP UNION CHEMICAL, CARTERET, N.J.

NOT TO SCALE





SITE LOCATION MAP UNION CHEMICAL, CARTERET, N.J.

MICAL, CARTERET, N.J.

SCALE: 1'= 2000'

CORPORATION

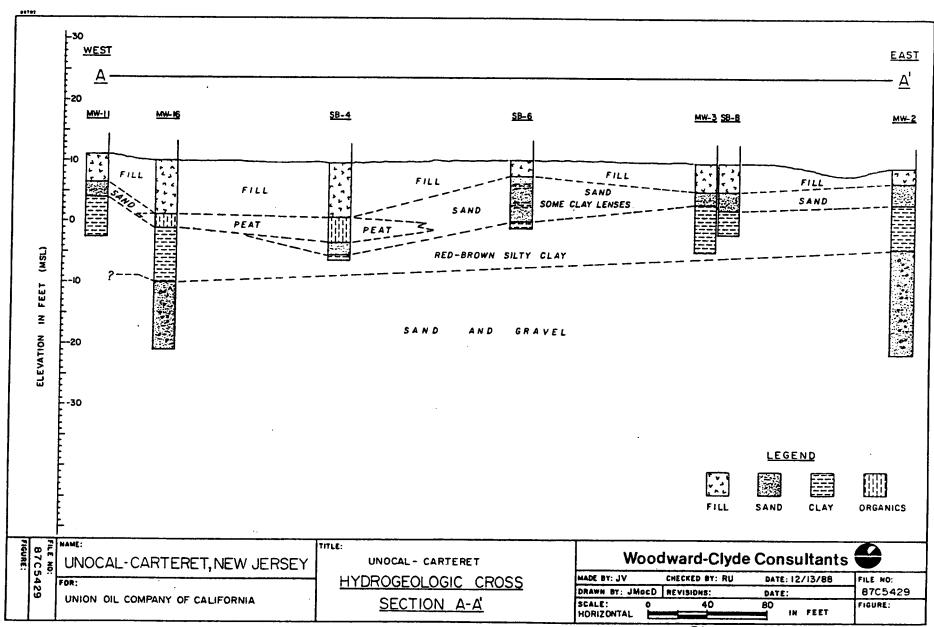


Figure 3

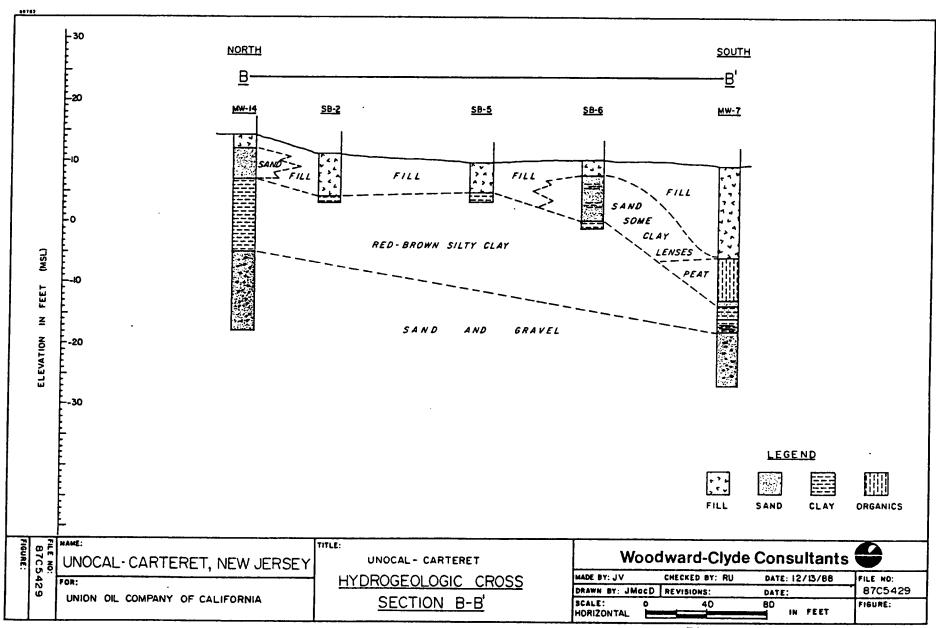


Figure 4

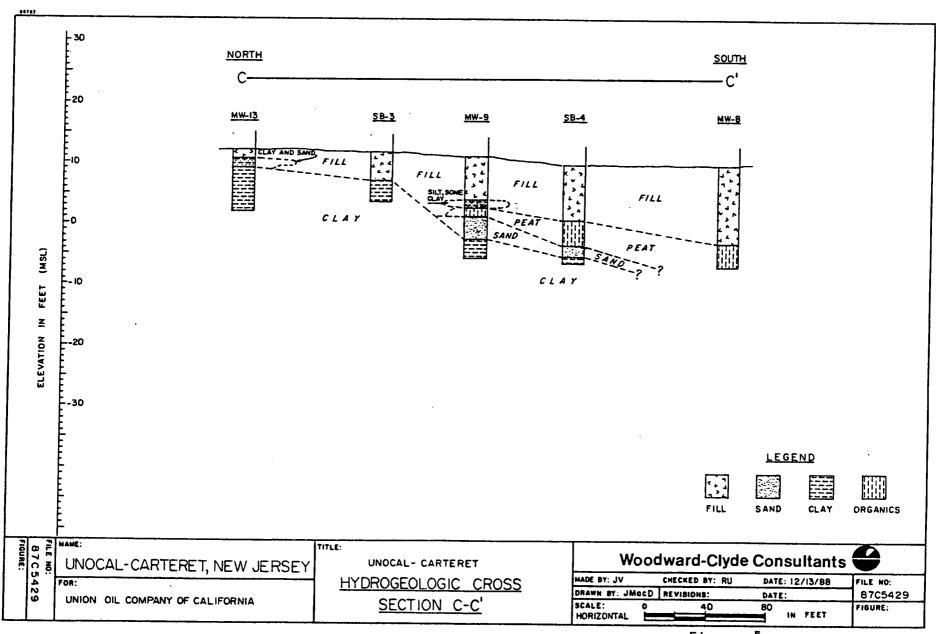


Figure 5

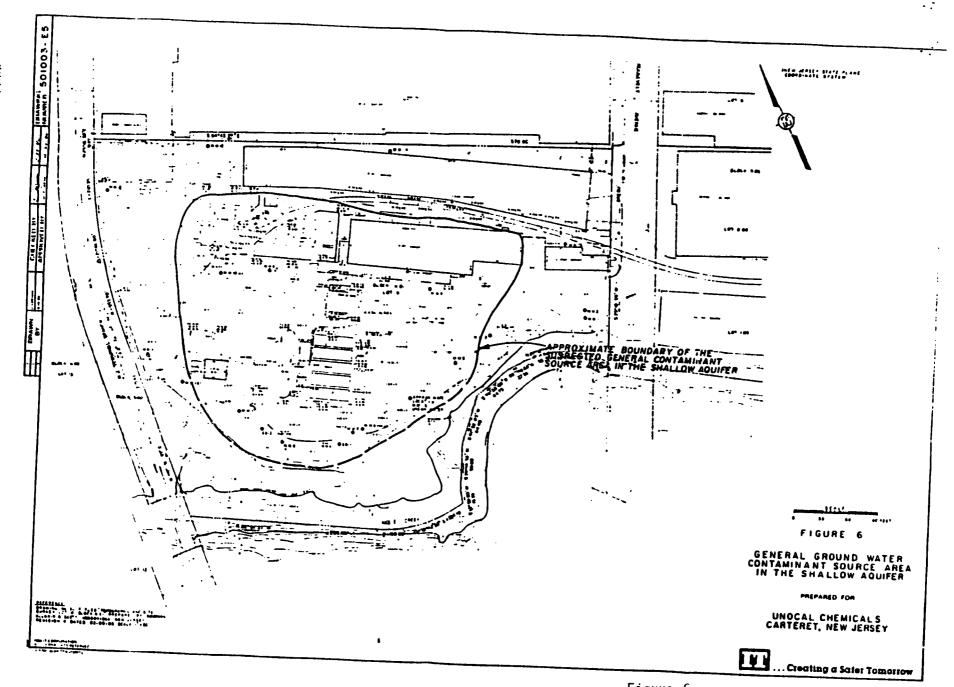


Figure 6

EXHIBIT A

PHOTOGRAPH LOG

UNION CHEMICAL CARTERET, NEW JERSEY

ON-SITE RECONNAISSANCE: MARCH 8, 1989

# UNION CHEMICAL CARTERET, NEW JERSEY

# MARCH 8, 1989

# PHOTOGRAPH INDEX

# ALL PHOTOGRAPHS TAKEN BY GLENN A. CALABRESE.

Photo Number	Description	Time
1P-1	Well No. 1.	1045
1P-2	Noes Creek looking east.	1058
1P-3	Noes Creek looking west.	1059
1P-4	The background area of disturbed soil was the location of the underground pipeline rupture causing the spills of 1983 and 1985.	1127
1P-5	Spill area of 1,1,1 - trichloroethane.	1120
1P-6	Vertical tank(No. 223)storage of 1,1,1, - trichloroethane.	1125



UNION CHEMICAL CARTERET, NEW JERSEY



1P-1

March 7, 1989 Well No. 1.

1045



1P-2

March 7, 1989 Noes Creek looking east.

1058



### UNION CHEMICAL



1P-3

March 7, 1989 Noes Creek looking west.

1059



1P-4

March 7, 1989

The background area of disturbed soil was the location of the underground pipeline rupture causing the spills of 1983 and 1985.

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UNION CHEMICAL CARTERET, NEW JERSEY



1P-5

March 7, 1989 1120 Spill area of 1,1,1 - trichloroethane.



1P-6

March 7, 1989
Vertical tark (No.223)storage of 1,1,1, - trichloroethane.

# 4.0 SITE INSPECTION SAMPLING RESULTS

NUS Corporation Region 2 FIT did not sample the site, as there are sufficient data to make a recommendation for **NO FURTHER REMEDIAL ACTION PLANNED (NFRAP)**. Data are discussed in Section 2.1.

# 5.0 CONCLUSIONS AND RECOMMENDATIONS

The groundwater of the Union Chemical Site has been contaminated with volatile organic compounds. Though contamination exists in the groundwater and surface water, no part of the population within a 3-mile radius utilizes groundwater, nor is there a surface water intake downstream. The Union Chemical owners have submitted a plan to the State for removal of contaminated soil. The plan is awaiting final approval by the State.

It is recommended that the monitoring wells continue to be sampled quarterly.

A recommendation of **NO FURTHER REMEDIAL ACTION PLANNED (NFRAP)** is given for this site, based on the lack of groundwater and surface water use. There is no significant potential for migration via the air route. There is some potential for direct contact with contaminated soils, although a large amount of soil has already been removed.

### 6.0 REFERENCES

- 1. Preliminary Assessment prepared by Frank Faranca, NJDEP, OHWM/BPA, May 22, 1987.
- 2. Field Notebook No. 0402, Union Chemical, TDD No. 02-8804-09, NUS Region 2 FIT, Edison, New Jersey, March 7, 1989.
- 3. Analytical results of soil borings for Union Chemical, Nanco Laboratories for Woodward-Clyde Consultants, September 1988.
- 4. Telecon Note: Conversation between Mr. Wolansky, Union Chemical, and Glenn A. Calabrese, NUS Corp., March 9, 1989.
- 5. Telecon Note: Conversation between Mr. D. Dierwerchter, Union Chemical, and Glenn A. Calabrese, NUS Corp., March 10, 1989.
- 6. Telecon Note: Conversation between Mr. Wolansky, Union Chemical, and Glenn A. Calabrese, NUS Corp., March 10, 1989.
- 7. Telecon Note: Conversation between Mr. D. Dierwechter, Union Chemical, and Glenn A. Calabrese, NUS Corp., March 16, 1989.
- 8. Flood Insurance Rate Map, Carteret, Middlesex County, NJ Community-Panel Number 340257 0005 A, November 15, 1978.
- 9. Quarterly Sampling Results, Unocal Chemicals, NJPDES #0026077, Groundwater Analyses, Woodward-Clyde Consultants, January 1989.
- 10. Three-mile radius map based on the U.S. Department of the Interior, Geological Survey Topographic Map, 7.5 minute series, "Arthur Kill Quadrangle, N.J." 1955.
- 11. Final Report for Union Chemical, Project 671030, IT Corporation, Nov. 25, 1985.
- 12. Uncontrolled hazardous waste site ranking system, A user's manual, 40 CFR, Part 300, Appendix A, 1986.
- 13. Telecon Note: Conversation between Mr. Sergio Leone, Union Chemical, and Glenn A. Calabrese, NUS Corp., April 14, 1989.
- 14. Final Report, Additional Site Assessment for Union Chemical, including Data Analyses. Project No. 303331, IT Corporation, December 1986.
- 15. Geology and Ground-Water Resources of Union County, New Jersey, U.S. Geological Survey Water Resources Investigations 76-73, June 1976.
- 16. Policies and Practices for Managing Middlesex County's Groundwater Resources, Middlesex County Planning Board, New Brunswick, September 1974.
- 17. Soil Survey Middlesex County, New Jersey, United States Dept. of Agriculture.
- State of New Jersey Department of Conservation and Economic Development, Division of Water Policy and Supply, Special Report No. 27, Henry R. Anderson, U.S. Geological Survey, 1968.

# 6.0 REFERENCES(Cont'd)

- 19. Fish and Wildlife Service List of Endangered and Threatened Wildlife and Plants, the Bureau of National Affairs, Inc. Washington, D.C. 20037.
- 20. Telecon Note: Conversation between Mr. Dellamo, Woodbridge Health Dept., and Glenn A. Calabrese, NUS Corp. February 16, 1989.
- 21. New Jersey and National Registers of Historic Places, NJDEP, Division of Parks and Forestry, 1984.
- 22. U.S. Fish and Wildlife Service, 1980. Atlantic Coast Ecological Inventory, Newark N.J.-N.Y.-PA. Sheet.

REFERENCE NO. 1



# Preliminary Assessment

Union Chemicals - Div. of Union Oil Co. 350 Roosevelt Avenue Carteret Borough/Middlesex County New Jersey

EPA # NJD063173280

# POTENTIAL HAZARDOUS WASTE SITE

LIDENTIFICATION

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SEPA

#### POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT PART 2 - WASTE INFORMATION

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SOL	Methylethyl					230,000	PPB
SOL	Chlorobenzen		108-90-7 74-83-9	Groundwater sample		1,400	PPB
SOL	Methylbromid			Surface water sample Surface water sample		2,700	PPB
SOL_	4-methyl-2-p	entanone	108-10-1			690	PPB
SOL	Styrene		100-42-5	Surface water sample		11	PPB
SOL	Trichloroeth		79-01-6	Groundwater sample Groundwater sample		630	PPB
SOL	Methylene Ch	Tolige	75-09-2	Groundwate	r sambre	630	LLD
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See reference sheet for a list of attachments

# **SEPA**

# POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT

PRELIMINARY ASSESSMENT

NJ | I

L IDENTIFICATION

O1 STATE 02 SITE MARGER

NJ D063173280

PART 3 - DESCRIPTION OF	HAZARDOUS CONDITIONS AND INCIDENTS
IL HAZARDOUS CONDITIONS AND INCIDENTS	10.11 0.10 P
01 X A. GROUNDWATER CONTAMINATION 03 POPULATION POTENTIALLY AFFECTED:	02 2 OBSERVED (DATE 10/10/85) - POTENTIAL C ALLEGED ON MARRATIVE DESCRIPTION
	nalyzed by IT Corporation on 10/10/85. Test results
	us volatile organic compounds including xylene as
high as 64,000,000 PPB. Both a h	orizontal and vertical migration of the contaminants Attachment C
01 X5. SURFACE WATER CONTAMINATION	02 X OBSERVED IDATE: 6/25/85 ) _ POTENTIAL _ ALLEGED
Groundwater discharges and surfac	e water seeps flowing into Noes Creek were sampled
and analyzed. High levels of var	ious volatile organic compounds were detected. A
	on Noes Creek by plant personnel. Attachment C
01 XC CONTAMINATION OF AIR 03 POPULATION POTENTIALLY AFFECTED.	04 NARRATIVE DESCRIPTION
NJDEP inspectors investigated the	facility during the $2/17/83$ spill incident in which
	y stained and a chemical odor was present. High
OVA readings WEAE 1-30 00859/50.	Attachment A
01 XD FIRE/EXPLOSIVE CONDITIONS 03 POPULATION POTENTIALLY AFFECTED	02 C. OBSERVED (DATE) X POTENTIAL C. ALLEGED
A potential for fire/explosive co	nditions exists due to the large amount of product
loss of highly volatile compounds	. However, in the two (2) years since the last
major spill many of the contamina	Affachment A, B
X Customary	X F271 (FAL ALLOSS)
63 POPULATION POTENTIALLY AFFECTED	04 NAHRATIVE DESCRIPTION
The entire facility is fenced to	prevent unauthorized access to the facility by the does exist for direct contact by Union Chemical
personnel.	
personner.	Attachment C, D
01 A F CONTAMINATION OF SOIL 03 AREA POTENTIALLY AFFECTED.	02 Ø OBSERVED (DATE: $\frac{3-17-93}{1}$ ) (3 POTENTIAL G ALLEGED 04 NARRATIVE DESCRIPTION
Three separate spill incidents we	re observed from 1983 to 1986 in which various
	eleased into the soil beneath the facility con-
sequently contaminating the groun	dwater. Attachment A, B
01 L. G. DRINKING WATER CONTAMINATION 03 POPULATION POTENTIALLY AFFECTED.	02 () OBSERVED (DATE) C POTENTIAL C ALLEGED O4 NARRATIVE DESCRIPTION
	ies potable water to the entire area surrounding the
facility. There are no known pri	vate wells located in the area.
	Attachment C, D
01 X H WORKER EXPOSURE/MURY 03 WORKERS POTENTIALLY AFFECTED:	02 TO OBSERVED IDATE
A potential exists for worker exp	osure/injury of Union Chemical personnel who come
into direct contact with the cont	aminated soil and ground water seeps that are
on site.	Attachment C
01 XI POPULATION EXPOSURE/INJURY 03 POPULATION POTENTIALLY AFFECTED	02 L. OBSERVED (DATE) POTENTIAL JALLEGED
A potential exists for population	exposure indirectly by ingestion of contaminated
fish caught in the Arthur Kill ar	nd by dermal and inhalation routes during the
recreational use of surface water	
	Attachment C

# **\$EPA**

# POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT

L IDENTIFICATION

O1 STATE O2 STE NAMEA

NJ D063173280

Att. C

PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

II. HAZARDOUS CONDITIONS AND INCIDENTS	·	
01 M J DAMAGE TO FLORA 04 NARRATIVE DESCRIPTION	02 COSERVED (DATE:)	POTENTIAL D ALLEGED
A potential exists for damage to	Phragmites communis species	s found on either side
of Noes Creek and the banks of t	he Arthur Kill.	
01 X K DAMAGE TO FAUNA 04 NARRATIVE DESCRIPTION (MEANING ASSESSED)	02 C OBSERVED (DATE)	*POTENTIAL C ALLEGED
The volatile organics in the gro		
the surface water/air interface,		
tants could accumulate in bottom	sediment with adverse effec	cts on aquatic biota.
01 X _ CONTAMINATION OF FOOD CHAIN 04 NARRATIVE DESCRIPTION	02 C OBSERVED (DATE)	· •
The migration of semivolatile or		
nonaqueous fraction of contamina		
in surface water and bio-magnify		
01 M UNSTABLE CONTAINMENT OF WASTES	02 CBSERVED (DATE)	S POLENLINT C WITEGED
C3 POPULATION POTENTIALLY AFFECTED.		
Volatile and semivolatile compout the environment through various		
OI X N DAMAGE TO OFFSITE PROPERTY OF NARRATIVE DESCRIPTION	02 C CESERVED (DATE)	POTENTIAL O ALLEGED
Groundwater discharges and seeps	to surface water may potent	tially contaminate pro-
perty down stream with volatile		
01 C O CONTAMINATION OF SEWERS, STORM DRAINS, W	WTPs 02 C OBSERVED (DATE	C POTENTIAL C ALLEGED
04 NARRATIVE DESCRIPTION		
The potential for contamination	of storm sewers does not ex	ist.
01 DP ELEGAL-UNAUTHORIZED DUMPING 04 NARRATIVE DESCRIPTION	102 C OBSERVED (DATE:)	D POTENTIAL C ALLEGED
There are no reports of unauthor	cized dumping within State as	nd local files.
OS DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR		
The Benjamin Moore Company was t	the previous property owners	(1920-1962) which
constructed a myriad of undergro	ound clay tile pipe and unde	rground tanks which may
still contain product.		
III. TOTAL POPULATION POTENTIALLY AFFECTED:		
IV. COMMENTS		
	•	•
V. SOURCES OF INFORMATION (Go LOCALE PRIORITERS	NO 1405 PROJECT CANALITY (ADDILITY)	
See reference sheet for a list of	of attachments.	

PA FORM 2070-12 (7-81)

# UNION CHEMICALS - DIVISION OF UNION OIL CO. 350 ROOSEVELT AVENUE CARTERET BOROUGH/MIDDLESEX COUNTY NEW JERSEY EPA # NJD063173280

The Union Chemicals Company is an active facility on a 4.4 acre parcel of land in Carteret Borough, Middlesex County. The facility is located in a heavily industrialized section of Carteret Borough and is owned and operated by Union Oil Company of California, AKA: American Mineral Spirits Co. The property is bounded by Noes Creek to the south, New Jersey Branch railroad tracks to the west, Roosevelt Avenue to the east, and the Wheeler Condenser and Engineering Company to the north. Development of this parcel of land began in 1920. The Benjamin Moore Company owned the property and operated until 1962 when Union Chemicals purchased the facility primarily for bulk storage and repackaging. In the years 1969 to 1984, anhydrous anmonia was processed to ammonia. Today, approximately 125 different products are handled at the facility, most of which are solvents.

The geology of the area is characterized by the Triassic Brunswick Formation, composed of soft red shale with sandstone beds, however, the Union Chemicals site is not consistent with the surrounding area. The facility is contructed on fill material which ranges in thickness from zero to fifteen feet and is composed of fine to coarse sand with gravel, clay, bricks, concrete, metal, glass, and slag. Beneath the fill are irregular deposits of sands, clays, silty clays, silt and peat which was probably deposited as a result of meandering and ensizing by Noes Creek. The movement of ground water flows from north to south across the site in the direction of Noes Creek.

The Union Chemicals facility has a past history of several product releases to the environment. The first major spill occurred on 2-17-83 when approximately 1860 gallons of MEK, petroluem napthalene, and propyl alcohol leaked into Noes Creek. This occurred as a result of a failure of an underground pipeline which was connected to a 12,000 gallon above ground tank. The second major spill occurred on 7-1-85 when approximately 500 gallons of xylene, toluene, napthalene, and benzene were also released into Noes Creek as a result of a failure in a 10,000 gallon underground tank (Tank #7). The leak was first noted by plant personnel as a large oil sheen on the creek and was traced to a 6" clay tile pipe adjacent to the creek bank. A review of the plant blue prints did not indicate any pipes of that material on the plant grounds. The pipe is believed to have been installed by the Benjamin Moore Company which formerly owned the site. To date, this pipe has not been removed from the site.

Union Chemicals contracted IT Corporation to conduct a site-assessment because of several product releases to the environment. IT installed twelve monitoring wells for ground water monitoring and to assess the direction and rate of ground water flow. The ground water sampling and quantitative analysis revealed significant (greater than 100,000 ppb) levels of xylene, toluene, benzene and chlorobenzene. Many other volatile organic compounds were also detected in smaller concentrations.

At present no remediation of the soil and ground water has been conducted. The USEPA has reviewed the work plan prepared by IT Corporation and determined that additional site information was needed to determine the full extent of contamination. The NJDEP/DHWM/Bureau of Field Operations has recommended that this case be closed because the site is being surpervised by the USEPA.

It is recommended that no further action be taken at the present time due to current investigations conducted by USEPA and IT Corporation. However, a future follow up investigation is recommended to assess the extent of remediation at the site.

Submitted by:

Frank Faranca, HSMS IV NJDEP/DHWM/BPA MSCA Project

Hours worked: 40 hours

REFERENCE NO. 2

UNION CHEMICAL 02-8804-09 TDD MGR.- G. CALABRESE LOGBOOK #0402 FEBRUARY 9, 1989

Pabe Subject

Subject

Sin -site Reconnaissance 3-1-89

Reconnaissance Phonolog

5-200 18 F Cold 02-8804-09 Cloudy Jo 25-35 winds Brown 3-7-89 Mon-sampling Site Investilation set-up Decon Alea at 1010 Held sakety meeting at 1030 The following individuals Hose nead the work plan and understood all the 9/4 requirements: 1. Winthing Frame 151/2000 2. MM/1 get 1550 3. Alem a. Calaber 1519 SCBA - 428552 192063 307/76 EPA senial No. 469783 Hhn - " "

O2-9804-09

MR. Serbio Leone Accompanied

US on Site.

5
WAIKEL Mound on Site And Pictures

are being taken. 1100 - Continued to walk & took more
pholos. trong and cold conditions exist. 11:30 Went bour oft on site of took move 11.45 Decon Pensonnel and loaded the site in Bornation à Departed site. as we wrived on site, the plant was bound to be active. Mr. Leane accompanied us everywhere we went on site as pictures 1,2, and 3 were taken, cl were used in the gumin's a mornawian Thay's I noticed the creek (1015) to be in a poorly kept condition. shough the maintaine of the creek is so probaby not Vouca cheminal's responsiblisting as we writed over to the vertical tanks northwest of the site o pictures 7-10, un taken The pipes that once fed underground in 1985, soil was still embed present on site.

ch could not visually see the contaminates soil due to it bling snow coverest. The servered the entire site. These vertical tonts are presently empty and are yndergoing refinishing the vertical tanto that 6. (. bulk starage taks and was were the cause of the spill of 1988. PHOTOS 11-18 were taken of thanks and spill were Tank # 223 is the tank which consider the spill liquid (1,1,1-Tricthurge ground has been discontited from tark # 223. The majority of the sign has been removed from the wrea . The contamint saif was removed until clay was reached. The wea has ben filled in with a soft songy material This soil time resuly inspected by the site manager. After the completion of the visual inspection of the site, Mr Leone and myself discursed the overview of the site. morel

1 沙鄉巴达

Nanco Sample ID: 88-SS-3230

Client Sample ID: SB-1

#### \*\*\*\*\*

### NANCO LABS, INC.

#### QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

00021

WOODWARD-CLYDE CONSULTANT 547 N. MONROE ST., SUITE 201 TALLAHASSE, FL. 32301

Date Received: 09/27/88 Date Reported: 11/04/88

PRIORITY POLLUTANT FRACTION VOLATILE COMPOUNDS BY GC/MS

MEDIUM LEVEL SOIL DILUTIONOF 1:125

Nanco Sample ID: 88-SS-3230

Customer Sample ID: SB - 1

		RES	ULTS	Q.C. BLANK	Q.C. MATRIX SPIKE			
CAS #	COMPOUNDS	SAMP.   CONC.  *UG/KG	MRL. *UG/KG	BLANK UG/KG	UNSPIKED SAMPLE UG/KG	CONC. ADDED UG/KG	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
71432	BENZENE	BMRL	625	N.D.	-    N.D.	50	104	114
	BROMODICHLOROMETHANE	l N.D.	625	N.D.	N.D.		104	114
	BROMOFORM	N.D.	625	i N.D.	N.D.		•••	•••
74839	BROMOMETHANE	N.D.	1,250	N.D.	N.D.	•••	•••	
56235	CARBON TETRACHLORIDE	N.D.	625	N.D.	N.D.	•••		•••
108907	CHLOROBENZENE	17,000	625	N.D.	N.D.	50	131	133
75003	CHLOROETHANE	N.D.	1,250	N.D.	N.D.			•••
110758	2-CHLOROETHYLVINYL ETHER	N.D.	1,250	N.D.	N.D.	•••		•••
67663	CHLOROFORM	I N.D.	625	N.D.	BMRL	• • •		•••
74873	CHLOROMETHANE	N.D.	1,250	N.D.	I N.D.	•••		
124481	DIBROMOCHLOROMETHANE	N.D.	625	i N.D.	i N.D.	•••	•••	•••
	1,2-DICHLOROBENZENE	N.D.	625	N.D.	N.D.		•••	•••
	1,3-DICHLOROBENZENE	N.D.	625	l N.D.	N.D.	•••		
	1,4-DICHLOROBENZENE	N.D.	625	l N.D.	I N.D.	•••	•••	•••
	1,1-DICHLOROETHANE	N.D.	625	l N.D.	1 N.D.	•••	•••	
	1,2-DICHLOROETHANE	N.D.	625	N.D.	N.D.		•••	
	1,1-DICHLOROETHENE	N.D.	625	N.D.	N.D.	50	162	131
156605	TRANS-1,2-DICHLOROETHENE	N.D.	625	N.D.	N.D.		102	131
	1.2-DICHLOROPROPANE	N.D.	625	N.D.	I N.D.	•••	•••	
10061015	CIS-1,3-DICHLOROPROPENE	N.D.	625	N.D.	N.D.	•••	•••	•••
	TRANS-1,3-DICHLOROPROPENE	N.D.	625	N.D.	N.D.	•••		•••
	ETHYLBENZENE	630	625	N.D.	N.D.	•••		•••
75092	METHYLENE CHLORIDE	1,500	625	1.100	1 22	•••		•••
	1,1,2,2-TETRACHLOROETHANE	N.D.	625	N.D.	i 22 i N.D.		•••	
	TETRACHLOROETHENE	N.D.	625	N.D.	N.D.	•••		•••
108883	TOLUENE	N.D.	625	N.D.	N.D.			
	1,1,1-TRICHLOROETHANE	N.D.	625 I	N.D.		50 	142	131
	1,1,2-TRICHLOROETHANE	N.D.	625 I	N.D.	N.D.   9	•••	•••	•••
	TRICHLOROETHENE	N.D.	625	N.D.	1 11	50	121	
	TRICHLOROFLUOROMETHANE	N.D.	625	N.D.	i ''   N.D.		141	135
	/INYL CHLORIDE	N.D.	1,250	N.D.	M.D.   M.D.	•••	•••	•••
			,,2,0	n.v.	M.D.	•••	•••	•••

N.D. = Not Detected

BMRL = Below Minimum Reporting Level

MRL = Minimum Reporting Level

<sup>\*</sup> RESULTS ARE BASED ON DRY WEIGHT

#### QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

10022

WOODWARD-CLYDE CONSULTANT

Date Received: 09/27/88 Date Reported: 11/09/88

	l RESL	JLTS	IQ.C. RE	PLICATES	1 a.c. R	I ANK & SDI	KED BLANK		ATRIV COL	· · · · · · · · · · · · · · · · · · ·
••••••		••••••	_						SP11	· · · · · · · · · · · · · · · · · · ·
COMPOUNDS	•	MRL. *MG/KG	İ		:	ADDED UG/L		UNSPIKED SAMPLE UG/L		% RECOVE
ANTIMONY	BMRL	15	BMRL	BMRL	ND	1,010		BMRL	500	90
ARSENIC	47.8	2.4	BMRL	BMRL	ND	47.0	106	BMRL	20	200
BERYLLIUM	1.2	1.2	I NO	ND	ND	481	105	DM	50	96
CADMIUM	BMRL	1.2	BMRL	BMRL	ND	489	103	ND	50	94
CHROMIUM	37	2.4	BMRL	BMRL	ND	506	107	BMRL	200	96
COPPER	59	6.1	BMRL	BMRL	ON	542	101	BMRL	250	99
LEAD	160	1.2	36	35	ND	24.5	106	BMRL	20	95
HERCURY	0.17	0.12	BMRL	ND	ND	5.2	108	BMRL	. 1	90
NICKEL	BMRL	9.8	ND	ND	ND	496	101	ND	400	108
SELENIUM	BMRL	1.2	BMRL	BMRL	ND	26.0	92 j	BMRL	10	86
SILVER	ND	2.4	ND	ND	ND	509	94	ND	50	80
HALLIUM	BMRL	2.4	ND	ND	ND	24.3	100 j	ND	50	84
!INC	407 	4.9	182	183	ND	3,100	96	228	200	244
SOLIDS	82		•			••••		••••		••••

N.D. = Not Detected

BMRL = Below Minimum Reporting Level

MRL = Minimum Reporting Level

<sup>\*</sup> RESULTS ARE BASED ON DRY WEIGHT

#### \*\*\*\*\*\*

### NANCO LABS, INC.

#### Surrogate Recovery - GC/MS Data

00023

Nanco ID	: 88-SS-3230	Date sample received: 09/27/88					
	Compound	Amount Added ug/kg	% Recovery	Control Lower	Limits X		
	FRACTION	• • • • • • • • • • • • • • • • • • • •	*******	••••••	• • • • • • •		
	Bromofluorobenzene	50	103	74	121		
	1,2 Dichloroethane d4	50	102	70	121		
	Toluene d8	50	63	81	117		

Nanco Sample ID: 88-88-3231

Client Sample ID: SB-3

#### NANCO LABS, INC. \*\*\*\*\*\*

#### QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

J0030

WOODWARD-CLYDE CONSULTANT 547 N. MONROE ST., SUITE 201 TALLAHASSE, FL. 32301

Date Received: 09/27/88 Date Reported: 11/04/88

PRIORITY POLLUTANT FRACTION VOLATILE COMPOUNDS BY GC/MS MEDIUM LEVEL SOIL DILUTIONOF 1:125

Nanco Sample ID: 88-SS-3231

Customer Sample ID: SB - 3

•••••	••••	RE	SULTS	Q.C. BLANK	Q.C. MATRIX SPIKE			
CAS #	COMPOUNDS	SAMP.   CONC.  *UG/KG	MRL. *UG/KG	BLANK     UG/KG	UNSPIKED SAMPLE UG/KG	CONC. ADDED UG/KG	SPIKE % RECOVERY	SPIKE DUP. % RECOVERY
7143	2 BENZENE	850	625	N.D.	i N.D.	50	104	114
7527	4 BROMODICHLOROMETHANE	N.D.	625	N.D.	N.D.		•••	•••
7525	2 BROMOFORM	N.D.	625	N.D.	N.D.		•••	•••
74839	9 BROMOMETHANE	N.D.	1,250	N.D.	J N.D.	•••	•••	•••
5623	CARBON TETRACHLORIDE	N.D.	625	N.D.	N.D.		•••	•••
108907	7 CHLOROBENZENE	N.D.	625	N.D.	N.D.	50	131	133
75003	CHLOROETHANE	N.D.	1,250	N.D.	N.D.	•••		•••
110758	3 2-CHLOROETHYLVINYL ETHER	N.D.	1,250	N.D.	N.D.	•••		•••
	CHLOROFORM	N.D.	625	N.D.	BMRL	•••		•••
74873	CHLOROMETHANE	N.D.	1,250	N.D.	N.D.	•••	•••	•••
124481	DIBROMOCHLOROMETHANE	N.D.	625	N.D.	N.D.	•••	•••	•••
	1,2-DICHLOROBENZENE	N.D.	625	N.D.	į N.D.	•••	•••	•••
	1,3-DICHLOROBENZENE	N.D.	625	N.D.	N.D.	•••	•••	
	1,4-DICHLOROBENZENE	N.D.	625	N.D.	N.D.	•••	•••	•••
	1,1-DICHLOROETHANE	N.D.	625	N.D.	N.D.		•••	•••
107062	1,2-DICHLOROETHANE	N.D.	625	N.D.	N.D.		• • •	•••
	1,1-DICHLOROETHENE	N.D.	625	N.D.	N.D.	50	162	131
156605	TRANS-1,2-DICHLOROETHENE	N.D.	625	N.D.	N.D.	•••	•••	•••
78875	1,2-DICHLOROPROPANE	N.D.	625	N.D.	N.D.	•••	•••	•••
10061015	CIS-1,3-DICHLOROPROPENE	N.D.	625	N.D.	N.D.	•••	•••	•••
10061026	TRANS-1,3-DICHLOROPROPENE	N.D.	625	N.D.	N.D.	•••	•••	•••
100414	ETHYLBENZENE	2,600	625 j	W.D.	N.D.		•••	•••
75092	METHYLENE CHLORIDE	4,900	625	1,100	1 22	•••	•••	•••
79345	1,1,2,2-TETRACHLOROETHANE	N.D.	625	N.D.	N.D.	•••	•••	•••
	TETRACHLOROETHENE	N.D.	625	N.D.	N.D.	•		•••
108883	TOLUENE	BMRL	625	N.D.	l N.D.	50	142	131
71556	1,1,1-TRICHLOROETHANE	N.D.	625	N.D.	N.D.	•••	142	131
	1,1,2-TRICHLOROETHANE	N.D.	625	N.D.	, n.b. I 9	•••	•••	•••
	TRICHLOROETHENE	N.D.	625	N.D.	; ,   11	50	121	135
	TRICHLOROFLUOROMETHANE	N.D.	625	N.D.	N.D.		121	133
	VINYL CHLORIDE	N.D.	1,250	N.D.	N.D.			•••
	•		,				•	

N.D. = Not Detected

BMRL = Below Minimum Reporting Level MRL = Minimum Reporting Level

<sup>\*</sup> RESULTS ARE BASED ON DRY WEIGHT

#### QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

00031

WOODWARD-CLYDE CONSULTANT

Date Received: 09/27/88 Date Reported: 11/09/88

METALS

COMPOUNDS				. CIONILS	Q.C. B	LANK & SPI	KED BLANK	1 Q.C. M	ATRIX SPIK	Œ
	:	MRL. *MG/KG	   FIRST 	SECOND UG/L	   Blank 	• • • • • • • • • •	*	UNSPIKED SAMPLE UG/L	CONC. ADDED	% RECOVER
ANTIMONY	!	14	BMRL	BMRL	ND	1,010	101	BMRL	500	90
ARSENIC	5.0	2.4	BMRL	BMRL	ND	47.0	106	BMRL	20	200
BERYLLIUM	1.4	1.2	NO	ND	ND	481	105	ND	50	96
CADMIUM	BMRL	1.2	BMRL	BMRL	ND	489	103	ND	50	94
CHROMIUM	12	2.4	BMRL	BMRL	ND	506	107	BMRL	200	96
COPPER	43	6.0	BMRL	BMRL	ND	542	101	BMRL	250	99
LEAD	59	1.2	36	35	ND	24.5	106	BMRL	20	95
MERCURY	BMRL	0.12	BMRL	ND	ND	5.2	108	BMRL .	. 1	90
NICKEL	BMRL	9.5	NO	ND	ND	496	101 j	ND	400	108
SELENIUM	BMRL	1.2	BMRL	BMRL	ND	26.0	92 j	BMRL	10	86
SILVER	DM	2.4	ND	ND	ND	509	94	ND	50	80
THALLIUM	ОМ	2.4	ND	ND	ND	24.3	100	NO	50	84
ZINC	101	4.8	182	183	ND	3,100	96	228	200	244
SOLIDS	84			j			į			

N.D. = Not Detected

MRL = Minimum Reporting Level

BMRL = Below Minimum Reporting Level

<sup>\*</sup> RESULTS ARE BASED ON DRY WEIGHT

#### Surrogate Recovery - GC/MS Data

00032

Nanco ID	: 88·ss·3231		received: 0		
	Compound		% Recovery	Lower	Limits %
VOLATILE	FRACTION	••••••	••••••	•••••	••••••
	Bromofluorobenzene	50	103	74	121
	1,2 Dichloroethane d4	50	97	70	121
	Toluene d8	50	113	81	117

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Nanco Sample ID: 88-SS-3233

Client Sample ID: SB-6

#### NANCO LABS, INC. \*\*\*\*\*\*\*

#### QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

00046

WOODWARD-CLYDE CONSULTANT 547 N. MONROE ST., SUITE 201 TALLAHASSE, FL. 32301

Date Received: 09/27/88 Date Reported: 11/04/88

PRIORITY POLLUTANT FRACTION VOLATILE COMPOUNDS BY GC/MS

MEDIUM LEVEL SOIL DILUTIONOF 1:125

Nanco Sample ID: 88-SS-3233 Customer Sample ID: SB - 6

			<b>WLTS</b>	Q.C. BLANK	Q.C. MATRIX SPIKE				
CAS	COMPOUNDS	SAMP.	••••••	BLANK	UNSPIKED	CONC.	SPIKE	SPIKE DUP.	
#		CONC.	MRL.	l	SAMPLE	ADDED	x	×	
		*UG/KG	*UG/KG	UG/KG	UG/KG	UG/KG	RECOVERY	RECOVERY	
•••••	• • • • • • • • • • • • • • • • • • • •							••••••	
71432	BENZENE	N.D.	625	N.D.	N.D.	50	104	114	
75274	BROMOD I CHLOROMETHANE	N.D.	625	N.D.	N.D.	•••			
75252	BROMOFORM	N.D.	625	N.D.	N.D.	•••	•••	•••	
74839	BROMOMETHANE	N.D.	1,250	N.D.	N.D.	•••	•••	•••	
56235	CARBON TETRACHLORIDE	N.D.	625	N.D.	N.D.		•••	•••	
108907	CHLOROBENZENE	4,500	625	N.D.	[ N.D.	50	131	133	
75003	CHLOROETHANE	N.D.	1,250	N.D.	N.D.		. •••	•••	
110758	2-CHLOROETHYLVINYL ETHER	N.D.	1,250	N.D.	N.D.	•••	•••	• • •	
67663	CHLOROFORM	ם.א.	625	N.D.	BMRL		•••	•••	
74873	CHLOROMETHANE	) N.D.	1,250	N.D.	N.D.	•••	•••	•••	
124481	DIBROMOCHLOROMETHANE	N.D.	625	N.D.	N.D.	•••	•••	• • •	
95501	1,2-DICHLOROBENZENE	N.D.	625	N.D.	N.D.	•••	•••	•••	
541731	1,3-DICHLOROBENZENE	N.D.	625	N.D.	N.D.	•••			
106467	1,4-DICHLOROBENZENE	N.D.	625	N.D.	N.D.	•••	• • •		
75343	1,1-DICHLOROETHANE	N.D.	625	N.D.	N.D.	•••	• • •		
107062	1,2-DICHLOROETHANE	N.D.	625	N.D.	N.D.	•••	•••	•••	
75354	1,1-DICHLOROETHENE	N.D.	625	N.D.	N.D.	50	162	131	
156605	TRANS-1,2-DICHLOROETHENE	N.D.	625	N.D.	N.D.	•••		•••	
78875	1,2-DICHLOROPROPANE	N.D.	625	N.D.	N.D.		•••		
10061015	CIS-1,3-DICHLOROPROPENE	N.D.	625	N.D.	N.D.			•••	
10061026	TRANS-1,3-DICHLOROPROPENE	N.D.	625	N.D.	N.D.	• • •	•••	•••	
100414	ETHYLBENZENE	1,100	625 j	N.D.	N.D.		•••	•••	
75092	METHYLENE CHLORIDE	1,200	625	1,100	22		•••		
79345	1,1,2,2-TETRACHLOROETHANE	N.D.	625 I	N.D.	N.D.	•••		•••	
	TETRACHLOROETHENE	N.D.	625	N.D.	N.D.	•••	•••	•••	
108883		BMRL	625	N.D.	N.D.	50	142	131	
	1,1,1-TRICHLOROETHANE	N.D.	625	N.D.	N.D.	•••	•••	•••	
	1,1,2-TRICHLOROETHANE	N.D.	625	N.D.	1 0	•••	•••	•••	
	TRICHLOROETHENE	N.D.	625	N.D.	1 11	50	121	135	
	TRICHLOROFLUOROMETHANE	N.D.	625 I	N.D.	N.D.		121		
	VINYL CHLORIDE	N.D.	1,250	N.D.	I N.D.	•••	•••	•••	

N.D. = Not Detected

BMRL = Below Minimum Reporting Level MRL = Minimum Reporting Level

<sup>\*</sup> RESULTS ARE BASED ON DRY WEIGHT

#### QUANTITATIVE RESULTS AND QUALITY ASSURANCE DATA

00047

WOODWARD-CLYDE CONSULTANT

Date Received: 09/27/88 Date Reported: 11/09/88

#### METALS

Nanco Sample	-3233		•••••	Customer Sample ID: SB-6							
	•		•		•	BLANK & SPI		Q.C. M/	TRIX SPIK	Œ	
# COMPOUNDS	SAMP.	MRL. *MG/KG	FIRST		BLANK	CONC.	x	UNSPIKED SAMPLE UG/L	CONC. ADDED UG/L	% RECOVERY	
ANTIMONY ARSENIC BERYLLIUM CADMIUM CHROMIUM COPPER LEAD MERCURY NICKEL SELENIUM SILVER THALLIUM ZINC	25   3.6   2.1   1.4   18   188   62   BMRL   11   ND   ND   ND	14 2.4 1.2 1.2 2.4 6.0 1.2 0.12 9.5 1.2 2.4 2.4 4.8	BMRL BMRL BMRL BMRL BMRL BMRL BMRL BMRL	BMRL BMRL BMRL BMRL BMRL BMRL 135 ND ND 183 1	ND	1,010 47.0 481 489 506 542 24.5 5.2 496 26.0 509 24.3 3,100	101 106 105 103 107 101 106 108 101 92 94 100 96	BMRL  BMRL  ND  BMRL  BMRL  BMRL  BMRL  ND  BMRL  ND  228	500 20 50 50 200 250 20 1 400 10 50 50 200	90 200 96 94 96 99 95 90 108 86 80 84 244	
!				 			   				

N.D. = Not Detected

BMRL = Below Minimum Reporting Level

MRL = Minimum Reporting Level

<sup>\*</sup> RESULTS ARE BASED ON DRY WEIGHT

#### Surrogate Recovery - GC/MS Data

00048

Nanco II		te sample received: 09/27/88				
	Compound		% Recovery	Lower	Limits % Upper	
VOLATILE	FRACTION	••••••	• • • • • • • • • •	********	•••••	
	Bromofluorobenzene	50	100	74	121	
	1,2 Dichloroethane d4	50	105	70	121	
	Toluene d8	50	101	81	117	

#### WOODWARD & CLYDE CONSULTANT

Date Received: 11/14/88
Date Reported: 11/22/88

#### E.P. TOXICITY METALS

Nanco ID: 88-SS-4779 Customer ID: SB - 1

	***************************************			
#	COMPOUNDS	RESULTS	UNITS	MCL
1M	ARSENIC	< 0.05	MG/L	5.0
2M	BARIUM	0.39	   MG/L	100
3 <b>m</b>	CADMIUM	   0.006	   MG/L	1.0
4н	CHROMIUM	l 0.053	   MG/L	5.0
5 <b>M</b>	LEAD	0.617	   MG/L	5.0
6М	MERCURY	< 0.0002	MG/L	0.2
7M	SELENIUM	< 0.075		1.0
88	SILVER	< 0.01		5.0
	•••••		1	

MCL = MAXIMUM CONTAMINATION LEVEL

#### WOODWARD & CLYDE CONSULTANT

Date Received: 11/14/88 Date Reported: 11/22/88

#### E.P. TOXICITY METALS

Na	nco I	0: 88-SS-4780 Customer ID:	: SB - 3			
1	#	COMPOUNDS	RESULTS	UNITS	MCL	ļ
	1M	ARSENIC	< 0.05	MG/L	5.0	1
1	2M	BARIUM	0.632	MG/L	1 100	1
	3M	CADMIUM	< 0.005	MG/L	i   1.0	1
	4 <b>M</b>	CHROMIUM	< 0.01	MG/L	5.0	1
	5M	LEAD	[	MG/L	l   5.0	l
	óМ	MERCURY	< 0.0002	MG/L	0.2	
1	7H	SELENIUM	< 0.075	MG/L	1.0	 
	8M	SILVER	< 0.01	MG/L	5.0	
ł			ī į			

HCL = MAXIMUM CONTAMINATION LEVEL

### WOODWARD & CLYDE CONSULTANT

Date Received: 11/14/88 Date Reported: 11/22/88

#### E.P. TOXICITY METALS

Nanc	:0 [[	: 88-SS-4781 Customer ID: SB -	4	***********		•
	#	COMPOUNDS	RESULTS	UNITS	MCL	- 
ļ	1H	ARSENIC	< 0.05	MG/L	5.0	 
	214	BARIUM	0.316	   MG/L	[ ] 100	1
	3 <b>M</b>	CADMIUM	0.009	MG/L	1.0	1
	4 <b>H</b>	CHROMIUM	< 0.01	MG/L	j 5.0	1
:	5 <b>M</b>	LEAD	0.348	MG/L	5.0	1
	6 <b>M</b>	MERCURY	< 0.0002	MG/L	0.2	
1 7	7 <b>H</b>	SELENIUM	   < 0.075	MG/L	1.0	1
8	34	SILVER	   < 0.01	MG/L	5.0	1
		••••	1	f		1

MCL = MAXIMUM CONTAMINATION LEVEL

#### WOODWARD & CLYDE CONSULTANT

Date Received: 11/14/88
Date Reported: 11/22/88

### E.P. TOXICITY METALS

Nanco 1	D: 88-SS-4782	Customer ID: SB - (	5	************	***********
#	COMPOUNDS		RESULTS	UNITS	MCL
1 1M	ARSENIC		< 0.05	MG/L	5.0
24	BARIUM		0.493	   MG/L	100
34	CADMIUN		< 0.005	   MG/L :	   1.0
4м	CHROMIUM		   < 0.01	   MG/L	   5.0
5M	LEAD		0.262	MG/L	5.0
64	MERCURY		   < 0.0002	MG/L	0.2
!   7M !	SELENIUM		   < 0.075	MG/L	1.0
1   8M	SILVER		< 0.01	MG/L	5.0
<b>!</b>		;	i i	i	1

MCL = MAXIMUM CONTAMINATION LEVEL

00 26C

NUS CORPORATION AND	D SUBSIDIARIES	TELECON NOTE
CONTROL NO:	DATE:	TIME:
02-8804-09	3-9-89	1440
DISTRIBUTION:		, , , ,
C'/	1	
Site Inc	(OR1179+101	
	_	
BETWEEN:	OF:	PHONE:
MR. Myron WOI	'Ansky Ullon C	Hemical (201) 574-9300
AND:	,	
Glenn A.	CAlabriese	
DISCUSSION:		
.7	Mr. Wolansky	· discussed
- unhace water	Late a spilling	ox 198711985 and
the location of	the mill unth	myself. Ite will
March of the last	1 0 1 +	1 de la sone
- Addit our war	tional information	for further
discussion with	me.	
A CTION CONTRACT		
ACTION ITEMS:		
	·	

NUS 067 REVISED 0665

NUS CORPORATION		TELECON NOTE
CONTROL NO:	DATE:	TIME:
02-8804-09	3-10-89	1500
DISTRIBUTION:	,	
Site InGon	mation	
BETWEEN:	OF: 0	PHONE:
MR. DARYL DIERW	sechter Of: Union e Hem	(3/2) 619-2613
۱ ۸		1001011 9010
Ghenn A. C.	Alabasse	(NUS)
DISCUSSION:	mr nonwell	
the Onlowing in	Paradia To COLL	e supplied me with
Com Bonney Jan	nkormation: In spill	#3 08 - 1488, 501h
1 ~1 .	to the clay layer	$\tilde{\mathcal{L}}$
1 🕳	ish-brown color.	
a	a copy of ±T's	second report.
the full send the	e surface water	sarple table.
		·
ACTION ITEMS: The will (	call back on 3-13-	-99
	are former and	<u> </u>

NUS 067 REVISED 0581

VUS CORPORATION AND	SUBSIDIARIES	TELECON NO
ONTROL NO:	DATE:	TIME:
<i>○</i> 3 8804 - 09 STRIBUTION:	3-10-89	1/30
	Bonmation	
TWEEN:  M. Mynon W.  D:	OF: Union CHA	(201) 574-9300
Mr. Glenn	A. CAlAbrese	
CUSSION:	Ma. Wolansky	explained the
83' spill in d	Ma. Wolansky  etail to me. 5)  - confirmed by  into detail also	he 85 and the
88 spills were	- sonfined by	Mr. wolanskin.
he also went	into detail alor	est those soille
		- square
· · · · · · · · · · · · · · · · · · ·		
ON ITEMS:		

### NUS CORPORATION

TELECON NOTE

CONTROL NO:	DATE:	TIME:	_
C2-8804-09	3-16-89	1400	
DISTRIBUTION:		7.700	
Site I,	Corimation		
	0 - 1 - 1 - 1 - 1 - 1 - 1		
BETWEEN:	OF:	Taucau	
MR. DARYL Di	erwichter CHemi	PHONE:	
AND:	Hemi	Cals (3/2)619-261	3
Glenn A C	-Alabnese		
ISCUSSION:		(NU	<b>(8</b> )
	1985 5011		
Contamus Lead	200	of XX #lene	
/ . le c a a	gnound water.	most of the spill	_
THE OVERZA	nderanound	nuntine it a nine to	44
was the CAUSE	of the heakage	to groundwater.	<u>4()</u> .
a log will be	Ment to	10 groundwater.	_
April of 1000	and not me a	occumenting the	_
24 LL 06 1985	log mon chemi	cals plant manager	
in 1985; at the	time of the	spill. Daryh will	_
end me the sec			-
1, - 61/ 0	it! H	Cl. The report	_
are supply me	and the water	surface water	
samples of noes	Creek. all 18 m	mitoling wells were	_
placed in by II	- Umin Chamical		-
plans of soil la	the It to any	1000 1 1000 10 Maral	-
	me availe. The	1986 & 1983 spell	_
removed in the	Pane general loca	time. Enoundwater	
I below the	surkare Both	rolls care from To is	-
¥7.		THE WINE WENT IANK	-
TION ITEMS:			4
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NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

BOROUGH OF CARTERET, NEW JERSEY MIDDLESEX COUNTY

COMMUNITY-PANEL NUMBER 340257 0005 A

(ONLY PANEL PRINTED)

EFFECTIVE
NOVEMBER 15, 1978



U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

FEDERAL INSURANCE ADMINISTRATION

### ATTACHMENT A

QUARTERLY SAMPLING RESULTS
JANUARY, 1989
UNOCAL CHEMICALS
CARTERET, NEW JERSEY
NJPDES #0026077

REGULATORY FORMS: GROUNDWATER ANALYSES

MONITORING WELL REPORTS

(FORM T-VWX-014, FORM VWX-015A, FORM VWX-015B,
FORM VWX-016, FORM VWX-017)

Woodward-Clyde Consultants CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS TALLAHASSEE, FLORIDA 32301

OPERATING EX	CEPTIONS DETAILE	<u>D_</u>																	
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	Others				<del>                                     </del>	1									Ī	İ	İ	•	
Day	of Month	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			
	Licensed Operator				Ī														

Others

## MONITORING REPORT - TRANSMITTAL SHEET

NUPOES NO.

REPORTING PERIOD .

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0101216101717

1 1 1 8 18 THE [01 1 8 19]

PERMITTEE:	Unocal Chemical		
· civilia Car.	Address 1345 North Meach	am Road	_
	Schaumburg, IL	60196	- -
FACILITY:	NameUnocal Chemicals	Division	-
	Address 350 Roosevelt Av	enue	-
	Carteret	(County) Middlesex	_
	Telephone <u>( 201 ) 541- 422</u>	24	
FORMS ATTACH	IED (Indicate Quantity of Each)	OPERATING EXCEPTIONS	
SLUDGE REPORTS	YRATINAZ	YES	NO NO
T-VWX-007	T-VWX-C	CO DYETESTONS	-
SLUDGE REPORTS	- INOUSTRIAL	TEMPORARY BYPASSING	<b>X</b>
T-VWX-010	100.00 T.VWY-0	DISINFECTION INTERRUPTION	
WASTEWATER REP	PORTS	MONTORES MALFUNCTIONS	<u> </u>
T-VWX-011		13 OTHER	<b>X</b>
GROUNOWATER RE	.8) 1 VWX-016 1 VWX-017	(Detail any "Yes" on reverse side in a <del>ppropriate</del> space.)	
NPDES DISCHARGE	моніто <del>лін</del> д я <del>єр</del> оят 3320-1	NOTE: The "Hows Assended at Plant" on reverse of this sheet must also be completed.	
AUTHENTICATIO	information submitted in this of those individuals immediate submitted information is true	r that I have personally examined and am familiar is document and all attachments and that, based or tely responsible for obtaining the information, I be accurate and complete. I am aware that there are information including the possibility of fine and it	n my inqu elieve the re signific
LICENSED OPERA	TOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE	
Name (Printed)	· · · · · · · · · · · · · · · · · · ·	Name (Arces) Daryl W. Dierwechter	
Grade & Registry No	o	Signature Supervisor Environment	al
Signature		_ Signature	<u> </u>
Date		Date March 21, 1989	

## ATTACHMENT A

QUARTERLY SAMPLING RESULTS
JANUARY, 1989
UNOCAL CHEMICALS
CARTERET, NEW JERSEY
NJPDES #0026077

REGULATORY FORMS: GROUNDWATER ANALYSES

MONITORING WELL REPORTS

(FORM T-VWX-014, FORM VWX-015A, FORM VWX-015B,
FORM VWX-016, FORM VWX-017)

Woodward-Clyde Consultants

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIROMENTAL SCIENTISTS 547 NORTH MONROE, SUITE 201 TALLAHASSEE, FLORIDA 32301

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	Licensed Operator											_	<u> </u>		_		1	1	
	Others										<u> </u>				<u> </u>	<u> </u>	<u> </u>	-	
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	Licensed Operator					l i	1 1					1			ł	l	1	1	

Others

## MONITORING REPORT - TRANSMITTAL SHEET

NUPDES NO.

REPORTING PERIOD .

MG, YR, MG, YR.

[0101216101717] [111 | 818 | THEO [011 | 819]

PERMITTEE:	Mancal Chemical			,
	Address 1345 North Meacham	Road		
	Schaumburg, IL	60196		
FACILITY:	Name <u>Unocal Chemicals Di</u>	vision	· · · · · · · · · · · · · · · · · · ·	
	Address 350 Roosevelt Avenu	e		
	Carteret	(County) Middlesex	<del></del>	
	Telephone <u>1 201 1 541- 4224</u>	**· <del>********</del> *		
FORMS ATTACH	HED (Indicate Quantity of Each)	OPERATUSE EXCEPTIONS		
SLUDGE REPORTS	- SANITARY		YEŞ	NO
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SLUDGE REPORTS	- INOUSTRIAL	DNIZZATYB YRARCTEGT		
T-VWX-01	DA T-VWX-0108	DISIMPECTION INTERRUPTION		<u> </u>
WASTEWATER RE	PORTS	MONITORE MALFUNCTIONS		<b>©</b>
T-VWX-011		UNITS OUT OF OPERATION OTHER		<b>∞</b>
GROUNOWATER R		(Detail may "Yes" on reverse side in appropriate space.)		
ш				
EPA FORM	EMONITORING REPORT	NOTE: The "Hows Attended at Place of this sheet must also be co		te
AUTHENTICATIO	information submitted in this do of those individuals immediately submitted information is true, ac	at I have personally examined and am focument and all attachments and that, be responsible for obtaining the informationate and complete. I am aware that formation including the possibility of firmation including the possibility.	iased on ion, I bei there are	my inquileve the significa
LICENSED OPERA	ROTA	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIV	E	
Name (Printed)	***	Name (Prices) Daryl W. Dierwech		
Grade & Registry N	o	Supervisor Environment Affairs	mmenta ———	
Signature	<del></del>	Signature	inet	<u>.                                    </u>
Date		Dete March 21, 1989		

OPERATING EXCEPTIONS DETAIL	.ED_			
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Month	Year	

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Licensed Operator																
Others																
Day of Month	17	18	19	20	21	22	23	24	25	25	27	28	29	30	31	
Licensed Operator																
Others											- 1	Ī				

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## MONITORING REPORT - TRANSMITTAL SHEET

NIPOES NO.

REPORTING PERIOD .

0101216101717

[1,1|8,8] THES [0,1|8,9]

PERMITTEE:	Unocal Chemical			
	Address 1345 North Meacham	Road		
	Schaumburg, IL	60196		
FACILITY:	NameUnocal Chemicals Di	ivision		
	Address 350 Roosevelt Avenu	ıe		
	Carteret	(County) Middlesex		
	Telephone <u>1 201 1 541- 4224</u>	• ***		
FORMS ATTACH	IED (Indicate Quantity of Each)	OPERATING EXCEPTIONS		
SLUDGE REPORTS	I-SANITARY		YES	NO
T-VWX-00	7 T-VWX-008 T-VWX-009	DYETESTONG		$\nabla$
SLUDGE REPORTS	- INOUSTRIAL	DHIZASYB YRARCHAST		
T-VWX-010	D. T.VWX-010B	DISIMPECTION INTERRUPTION		
WASTEWATER REA		MONTI DRUNG MALFUNCTIONS		
T-VWX-011		UNITS OUT OF OPERATION OTHER		<b>X</b> 2
GROUNOWATER RI	EPORTS ,B) 1 VWX-016 1 VWX-017	(Descil eary "Yes" on reverse side in a <del>ppropriate</del> space.)		
NPOES DISCHARGE	монітоянь я <i>ег</i> оят 3320-1	NOTE: The "Hows Arrended at P!		te
AUTHENTICATIO	of those individuals immediately submitted information is true, ac	at I have personally examined and am facument and all attachments and that, be responsible for obtaining the information curate and complete. I am aware that the complete incuration including the possibility of fin	ased on on, I bei here are	my inquieve the signific
LICENSED OPERA	TOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE	:	
Name (Printed)		Name (Prison) Daryl W. Dierwecht Supervisor Environ	er	
Grade & Registry No	o	Title (Print) Affairs		
Signature		Signature Day Ou	inet	<u>t.                                    </u>
Date		Date March 21 1989		

Farm VMX-317 4/83

## TOTAL PROPERTY OF THE PROPERTY WATER QUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT WIT	TH BALL POINT DEN
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FACILITY NA	unocal Unocal	Chemicals - Carteret	. NJ	SW 10 NO _MW-1	
LAS NAME		Laboratories - Wapping			
Ū	NJPOES NO.	WELL PERMIT NO. 216-08552-6	SAMPLE DATE YR.   MO.   DAY   8 9 0 2 0 7   17 22	MJ LAB CERT. NO.	WCM USE

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 0 18 8 18 TO 0 18 91 2 MO. YR.

												SUBMIT WITH SIGNED	T-VWX-014													
		SA	WP (	.IN	G M	101	4 T	HS	5																	
	9			Jun.	75	Aug		į	<u>ت</u>	No.	D	ANALYSIS	UNITS	PARAMETER							VALUE					
<u>x</u>	$oldsymbol{\downarrow}$	<u> </u>	1_	ot	X	<u> </u>	<u> </u>	1	x		L	Specific Conductance	umhos/cm	I	I		I	Ī	$\prod$	T	I		2 0	5/2	1	4
<u> </u> X	+	<u> </u>   X	<u> </u> 	<u> </u> 	X	1	<u> </u>	+	X			Floating Product		1	1	+	_	1	4	1	1	1	1	1	1	_
+	t	T	1	<u> </u>		<u> </u>	<u> </u>	$^{+}$	1			110dtling 110ddt	inches	╀	+	$\frac{1}{1}$	$\frac{1}{1}$	+	+	+	Ļ	$\frac{1}{1}$	$\frac{\perp}{\tau}$	$\frac{1}{1}$	1	0
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<u>!</u>	<u>                                     </u>		_	-	<u> </u>	<u> </u>		<u> </u>	+	<u> </u>	$\dashv$			L	ļ	Ļ	1	1	$\downarrow$	<u></u>	Ī	1	Ī		I	_
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+	+	<u>:</u> 	<del> </del>	<u>;</u>	<u> </u> 		<u> </u>	1		<u> </u>	+			$\frac{1}{T}$	4	<u> </u>	1	4	<u> </u>	<u> </u>	<u> </u>	_	-	!	1	_
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/AL	UE	C	201	NC DE	i a	UL	.E:	5 <i>i</i> EV	4 N	0	ε .		29 42 55 68	<u>.                                    </u>	<u>'</u>	<u>-</u>	3	3 :	47 50			<u> </u>			13 3	\$ 4 4 ?

Fem **VW**X-017 72

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

### GROUND WATER ANALYSIS - MONITORING WELL REPORT

	ACTO.	BY25/V501XYT	OKCANIC	COMPOUNDS
7	7 A			<del>-</del>

FACILITY N	Unocal Chem	icals - Carteret, NJ		5W 10 NO. MW-1	
LAE AME	NANCO Labor	atories - Wappingers F	alls. NY		
•	MFDES NO.	WELL PERMIT NO.	BANGLEDATE . TR.   NO.   DAT	NJ LAB CERT, NO.	WOU LEE
<u>,</u>	4499490	26-08552-6	890207	713141610	

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM | D IR | R IR | TO | DIR | 012 |

#### SUBMIT WITH SIGNED T-TWX-014

SAMPLING MONTHS				
11111111111	AMALYES	UNITE	PARAMETER	VALUE
	Chrysene	ug/1	34320	
	Dibenzanthracene	ug/1	3 4 5 5 6	<del>                                      </del>
	1,2-Dichlorobenzene	ug/1	3 4 5 3 6	
· <b>                                     </b>	1.3-Dichlorobenzene	ug/1	3 4 5 6 6	<del>                                     </del>
	1,4-Dichlorobenzene	ug/l	3 4 5 7 1	
	3,3'-Dichlorobenzidine	ug/1	3 4 6 3 1	<del>                                     </del>
	Diethyl Phthalate	ug/1	3 4 3 3 6	
	Dimethyl Phthalate	ug/1	3 4 3 4 1	
	Di-n-butyl Phthalate	ug/1	39110	<del>                                     </del>
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1	
	2,6-Dinitrotolulene	ug/1	3 4 6 2 6	
	Di-m-octyl Phthalate	ug/1	3 4 5 9 6 1	
	1,2-Diphenylhydrazine	ug/1	3 4 3 4 6	++++
	Fluoranthene	ug/1	3 4 3 7 6	<del>-                                      </del>
	Fluorene	ug/1	34381	<del>-                                    </del>
	Bexachlorobenzene	ug/1	39700	<del>-                                    </del>
	Hexachlorobutadiene	ug/1	3 4 3 9 1	<del>-  -  -  -  -  -  -  -  -  -  -  -  -  -</del>
	Hexachlorocyclopentadiene	ug/1	3 4 3 8 6	<del></del>
	Hexachloroethane	ug/1	3 4 3 9 6 1	<del></del>
	Indenonvrene	1	<del></del>	<del></del>
		ug/1	3 4 4 0 3 1 1	<del></del>
	Isophorone	ug/l	3 4 4 0 8 1	╀┼┼┼┤
	Naphthalene \	ug/l	3 4 6 9 6 1	<del></del>
	Mitrobenzene	ug/1	3444711	11111
	H-Mistagndinenslyamine		3 4 4 3 9 1	11111
	N-Nitrosodi-n-propylazine	ug/1	3 4 4 2 8 1	
<del>-                                      </del>	N-Hitrosodiphenylamine	ug/l	3 4 4 3 3 . 1	
	Phenanthrene	- uz/l	3 4 4 6 1	
	Pyrene	ug/1	3 4 4 6 9 1	
	1,2,4-Trichlorobenzene		3455111	

VALUE CODING RULES AND REMARK CODES ON REVERSE Ferm YMX-017 UZJ P1

VALUE CODING RULES AND

### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

WATER QUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYP	E OR PRINT WITH BALLPOI	NT PEN		ISW ID NO.	
FACILITY A	Unoc	al Chemical - Carteret,	NJ	MW-1	
LAS NAME	NANCO Labor	atories - Wanningers Fa	lls NY		
Ū	N. 0 0 2 6 0 7 7	26-08552-6	890207	7 3 4 6 0	MGW (ZE

THE SCHEDULE INDICATED SELOW IS TO SE DESERVED FROM 10 8 8 8 TO 10 18 19 12

				•								SUBMIT WITH SIGNED TO THE	r-014	:		
			•		46	1	ж	Τd	•		•	•				FMARK
1	1	į	j	<b>.</b>	Į	₹	Į	1	ž	į	į	ARALYES	ENITS	PARAMETER	VALUE	Ĭ
F	T		प्रो	=	Ì	Ť	٦	$\Box$	X	Ī		2-Chlorophenol	ug/1	3 4 5 8 6		$oldsymbol{\perp}$
1	t	H	1	7	1	1				Γ		2,4-Dichlorophenol	ug/l	34601		$\perp$
+	1	H	.†	+	7	7			:			2,4-Dimethylphenol .	ug/1	34606	1 1 1 1 1	
<b>+</b>			1	Ť	1	7						2,6-Dinitro-o-cresol	ug/l	. 7 7 6 0 3		
T		$\sqcap$	11	Ť	1	1			_	Г	П	2,4-Dinitrophenol	ug/1	3 4 6 1 6	<u> </u>	$oldsymbol{\perp}$
<b>T</b>		$\Box$	ī	T	7	Ť	1		П			2-Nitrophenol	ug/1	3 4 5 9 1		$\sqcup$
T			1	$\dagger$	寸	1	٦		П	Γ		4-Nitrophenol	ug/I···	3 4 6 4 9		
<b>†</b>		十	Ť	Ť	i	T	٦		1			p-Chloro-s-cresol	ug/l	3 4 4 5 2		$\sqcup$
		H	1	Ť	Ť	Ť	٦		П			Pentachlorophenol '	ug/l	3 9 0 3 2		Ц
+			Ť	十	Ť	十	1		7			Phenol	ug/1	3 4 6 9 5		Ц
H	†	H	i	Ť	i	Ť	i	i				2,4,6-Trichlorophenol	ug/1	3 4 6 2 1	1 1 1 1 1 1	Ц
+	$\vdash$		Ť	十	Ť	十	٦	i						1   1   1		Ш
+	$\vdash$		†	†	+	i	i	i	-			Acenenhahene	uz/1	3/4/2/0/5		Ц
-		$\Box$	Ť	Ť	ī	T		T	il			Acenaphthylene	ug/1	3 4 2 0 0	1 1 1 1 1 1	Ц
			Ť	Ť	Ť	Ť	i	Ī	1		П	Anthracene	ug/l	3 4 2 2 0	1 1 1.1 1	Ц
1		$\Box$	1	+	Ť	Ť	1					Benzidine	ug/l	3 9 1 2 0		$\sqcup$
	İ	П	T	Ť	T	Ť	1	T				Benzanthracene	ug/1	3 4 5 2 6		Ц
<b>T</b>	<del>i</del>	i	Ť	Ť	İ	Ť	Ī	Ì	-		П	Benzopyrene	ug/1	3 4 2 4 7		$\sqcup$
	†		Ť	Ť	Ī	Ì	Ì	Ī				3,4-Benzofluoranthene	ug/1	3 4 2 3 0		Ц
<b>+</b>	İ	Ħ	十	Ť	Ť	Ť	i	i	:			Benzoperylene	uz/1	3 4 5 2 1		Ц
		$\vdash$	Ť	t	Ť	Ť	i	i	j			Benzofluoranthene	ug/1	3 4 2 4 2	1 1 1 1 1	Ц
H			+	Ť	1	寸	7	寸	1			Bis(2-chloroethoxy)methane	ug/1	3 4 2 7 8		Ц
		1	$\dagger$	Ť	Ť	Ť	i	T	ij			Bis(2-chloroethyl) Ether	ug/1	3 4 2 7 3		Ц
+		+	$\dagger$	$\dagger$	$\dagger$	Ť	1	寸	1			Bis(2-chlroisopropyl) Ether	ug/l	3 4 2 8 3		Ц
+	$\vdash$		t	$\dagger$	$\dagger$	+	+	i	<del>.</del>			Bis(Z-ethylhexyl) Phthalate	ug/l	3 9 1 0 0		Ц
		十	Ť	Ť	$\dagger$	十	i	寸	1			4-Bromophenyl Ether	ug/l .	3 4 6 3 6	11111	Ц
	Н	$\dashv$	Ť	†	†	十	i	Ť	+			Butvlbenzyl Phthalate	_ug/1	3 4 2 9 2	<del>!                                    </del>	Н
	П	$\top$	Ť	Ť	1	$\dagger$	Ť	Ť	Ť		$\sqcap$	2-Chlosomenhahelene	112/1	13/4/5/8/1	<del>                                     </del>	Н
T	П	十	1	T	T	T	7	T	1			4-Chlorophenyl Phenyl Ether	ug/1	13 4 6 6 4 1 1	1 1 1 1 1	
	ш				<u>.</u>									29 11 2	40	41

## NO:TOSTOPPARTMENT OF ENVIRONMENTAL PROTECTION COSTOSTAND NOISIVIO

#### WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

please type	OR PRINT WITH BALLPON	nt Pen			
FACILITY NA	ME UnocalChemi	cal _ Carteret, NJ		5W 10 NO. MW-1	
LAB NAMÉ	NANCO Labor	atories- Wappinger Fal	ls. NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	. LAB CERT, NO.	WQM USE
Ţ	uldd sled y y	26-085526	8 9 0 2 0 7	7 3 4 8 0	

THE SCHEDULE INDICATED SELOW IS TO SE OBSERVED FROM 10 18 8 18 TO 10 18 91 2

#### SUBMIT WITH SIGNED T-VWX-014

Sampling months				
Fab. Mar. May. May. Aun. Aun. Sapt. Nov.	ANALYSIS	ZTINU	PARAMETER	VALUE
MINIM	Acrylonitale	UG/L	3 4 2 1 5	1
	Benzene	UG/L	3 4 0 3 0	1
	Bromoform	UG/L	3 2 1 1 0 4	
	Carbon Tetrachtoride	UG/L	3 2 1 0 2	
	Chiarabenzene	UG/L	3 4 3 0 1 1	8 . 2
	Chlorodibramoethane	UG/L	3 4 3 0.6	11111
	Chloroform	UG/L	3 2 1 1 0 1 5	1
1 111 1 111 1 111 1	1, 1 - Dichtoroethane	UG/L	3 4 4 19 16	1111;
1 111 1 111 1 111 1	1, 2 - Dicatoroethane	UG/L	314 5 3 1	!     ! !   11
1 111 1 111 1 11! 1	1, 1 - Dichlargethylene	UG/L	3 4 5 0 1	
1 11: 1 11: 1 1:: 1	1, 2 - Dichloropropane	UG/L	3 4 5 4 1	1
1 1 1 1 1 1 1 1 1 1 1 1	Emylbenzene	UG/L	314 317 1	1 1 1 1 1 1
1 11: 1 11: 1 11: 1	Methylene Chloride	UG/L	3 4 4 2 3	1   1   21.   8
1 11 1 11 1 1 1 1	1, 1, 2, 2 - Tetrachtorpemane	UG/L	3 4 5 1 5	1     1   1
1 11 1 11 1 11 1	Tetrachioroethylene	UG/L	3 4 4 7 5	. [ ] ] [ ] [ ]
1 11: : !	Taluene	UG/L	3 4 0 1 2	1i. 9
1 :1: 1 :1: 1 11: 1	1, 1, 1 - Trichloroethane	UG/L	31415:015	1     1 ! : 1
1 11 1 1 1 1 1 1 1	1, 1, 2 - Trichtorpethane	UG/L	314151111	i   i   i   i   1
1 111 1 111 1 111 1	Trichlorosthylene	UG/L	3 9 1 3:0	1   1   1   1
	Vinyl Chloride	UG/L	3191117 5	1   1   1
	Acraiein	UG/L	314 2 1 0	1 1 - 12:5
	Chloroethane	UG/L	314 3:1.1	. i . i . 1
	2 - Chiarpethylvinyl Ether	UG/L	3:415:7.5	: :       1
	Dichlorogramomethane	UG/L	3 2 1 0 5	:       1
	1, 3 · Dichtargargaytene	UG/L	314 6 9 9	1
	Methyl Bromide	UG/L	3 4 4 1 3	1
	Metnyl Chloride	UG/L	3 4 4 1 1 8	1 1 1 1 1
	1. 2 - trans - Dichtorgethylene	UG/L	3 4 5 4 5	1 1 1 1 1
	1, 2 Dichtgrobenzene	UG/L	3141513!5	· · · · · · · · · · · · · · · · · · ·
1 1 1 1 1 1 1 1 1 1 1	1, 3 Dichigrapentene	UG/L	314 5;5:6	1 1 1 1
	1, 4 Dichloracenzene	UG/L	314151711 1	1 : 1 ! ! 1
ALUE COOING RULES AND			29 J3 J4 42 46 47 33 39 70 68 72 73	10 53 54 13

VALUE CODING RULES AND REMARK CODES ON REVERSE

#### WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT WITH BALLPOINT PEN

FACILITY NA	ME Unocal Chemi	cals - Carteret, NJ		SW 10 NO. MW-1	
LAS NAME		utories, Wappingers F	alls. NY		
	NIPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR. 1 MO. 1 DAY	NJ LAB CERT, NO.	WOM USE
S	N-0 0 2 6 0 7 7	2 6 -0 18 15 15 12 -6	89 0207	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO SE OBSERVED FROM ON BEAT TO 18 19 12

### SUBMIT WITH SIGNED T-VWX-014

		S	اسد	PLI	NQ	M	QN	ТН	\$						
4	Feb.	Mar.	Apr.	Key	•u√	July	Aug.	Sept	061.	Nov.	Dec.	ANALYSIS	UNITS	PARAMETER	VALUE .
										Ī	I	Methaxychlar, Tatal	UG/L	3 9 4 8 0	
				Ì								Methylene Blue Active Substances	MG/L	3 8 2 6 0	
								1			Γ	Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	0 0 6 0 8	
												Nitrogen, Nitrate Dissolved	MG/L as N	0 0 6 1 18	
			_}									Odor	T.O.N.	0 0 0 8 5	-
			X	T					İ			Н	Standard Units	004100	1 17 12 2
	1	1	١	Ī	Ī	1						Phenois, Total Recoverable	UG/L	3 2 7 3 10	
1	Ī	T	T	T	Ī	Ī	إ					Radium 225, Dissolved	PeiL	0 9 5 0 3	ilili
Ī	Ĭ	T	Ī	T	Ī	Ī						Radium 228, Dissolved	Pe/L	8 1 3 6 6	
Ī	Ī	-	1	1	1	T						Selenium, Dissalved	UG/L	0 1 1 4 5	
Ī	1	Ī	T	T	Ī	T	-		-	1		Silver, Dissalved	UG/L	0 1 0 7 5	11111
1	T	Ī	Ī	T	T	T	1	١	1	- 1		Sadium, Dissalved	MG/L	0 0 9 3 0	
	1		X	1	T	T	-			-		Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	010191415	
X	1	1)	XT	1		X	1	$\overline{1}$	X			Tatal Dissolved Solids (TDS)	PPM	7 0 3 0 0 1	1 5 8 0
Î	T	Î	Ī	Ī	Ī	Ì	Ī	1		1		Total Organic Carbon (TOC)	PPM	0 0 6 8 0 1	11111
Ī	1	Ī	1	1	1	Ī	Ī	1	-	Ī	1	Total Organic Halogen (TOX)	UG/L	7 0 3 5 3	1 1 1 1
T	Ī	Ī	T	T	Ī	T	1	1	Ī	Ì	$\forall$	Taxabrene	UG/L	3 9 4 0 0 1	
İ	Ť	Ť	Ť	Ť	Ť	Ť	Ť	i	Ì	Ì	1	Turbidity	NTU	0 0 0 7 6	11111
Ť	Ī	Ĭ,	ते	Ī	Ì	1	Ť	Ī	Ť	Ť	$\top$	Zinc, Dissalved	UG/L	0 1 0 9 0 1	
Ť	Ť	ĺ	1	Ť	Ī	Ť	Ť	i	1	Ī	<del>-i</del>	2. 4-0. Total	UG/L	3 9 3 7 0 1	11111
Ť	Ť	Ť	T	Ť	Ť	Ť	Ť	Ť	Ť	Ť	-	2. 4. 5—TP. Total	UG/L	3 9 0 4 5 1	11111
T	Ť	Ī	Ì	Ť	İ	Ì	İ	Ť	Ť	Ť	$\dagger$				11111
Ť	Ť	İ	Ť	<del></del>	İ	Ť	İ	Ť	i	i	$\dagger$				11111
Ť	Ť	Ť	Ť	Ť	i	Ť	Ť	ij	Ť	Ť	$\dagger$				11111
Ť	Ť	Ť	Ť	T	Ι	<del>i</del>	Ť	Ť	Ť	Ť	$\dagger$				
<del>i</del>	Ť	Ť	†	İ	<del>,</del>	<del>i</del>	<del>i</del>	ij	<del> </del>	i	+				<del>                                      </del>
Ť	÷	Ť	$\dot{\top}$	<del>'</del>	1	1	+	$\frac{1}{1}$	i	Ť	+				
†	$\dot{\top}$	+	<del></del>	Ĺ	<u> </u>	<u> </u>	$\frac{1}{1}$	<del>'</del>	+	<del>'</del>	+				
<u> </u>	<u> </u>		!	<u>!</u>	<u>'</u>	<u> </u>	<u>'</u> -			<u>'</u>				23 13 24	

VALUE COOING RULES AND REMARK CODES ON REVERSE

## W JERSEY DEPARTMENT OF THE NOTHER PROTECTION DIVISION OF WATER RESURCES

#### WATER QUALITY MANAGEMENT ELEMENT

#### GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

FACILI	TY NA	MÉ ü	noca	1 C	hem: sal Carteret NJ		SWIONO	<b>I-1</b>	
ده قدا	ME				•			<u> </u>	
	<del></del>	NANL	n rar	ora	tories, Wappingers Falls, NY	LE DATE			
			NJPOE	S NO.		HO. I DAY	NJ LAB CERT. N	0.	WOM US
R	]	NJ d	dde	d d :	7 26-085526 8190	12017	7 3 4 6 0	]	
1	<b>-</b>	2			å 9 1ú 17	***	23 21	•	
THE	SCHED	ULE INO	ICATE!	) SEL	OW IS TO BE OBSERVED FROM ON TO	0 18 19 12 ]			
					SUBMIT WITH SIGNED T-VWX	-014			
	SAMP	ING MO	VTHS						
4	A P	A the same	Se i	Ne.	ANALYSIS	UNITS	PARAMETER	VA	LUE
<del>Л</del> Т	M	TM	TN	11	Elevation of top of well casing with eap off	feet MSL:			TII
<u> </u>	M	! M	İΝ	1	(as specified in well completion report)	to nearest .01			81.12
$X \mid X$	X		1 X		Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01			اوا اھ
11	M	M	TN	11	Depth to water table from top of casing prior to	fest: to	8 2 5 4 6		111
<del>} !</del>	N.	IM	$+ \sim$	<del>   </del>	sampling with cap off	nearest 01	<del>                                     </del>	, I	7   5   5
	X		IX		Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9		8. 2
1	X		11		Arsenic, Dissolved	UG/L as As	011000	111	
11		111			Barium, Oissolved	UG/L as 3a	0 1 0 0 5	111	111
TI	il				Biochemical Oxygen Demand - 5 Day	MG/L	003110		
Π	11				Cadmium, Dissolved	UG/L as Cd	0 1 0 2 5		111
11	X	IX	ΙX		Chloriae, Dissalved	UG/L as CI	8 2 2 9 5	161619	9 7 10 1
11	11				Chromium, Dissolved	UG/L as Cr	0 1 0 3 0	<u> 1   [ ] </u>	111
					Chromium, Dissolved, Hexavalent	UG/L as Cr	0 1 2 2 0	111	111
				1.	Chemical Oxygen Demand (COD), Dissolved	MG/L	0 0 3 4 1	111	111
	Ī				Caliform Group	N/100 ML	7 4 0 5 6	111	111
					Color	Pt - Ca	00001810	1 1 1	111
					Capper, Dissalved	UG/L as Cu	011040		111
		1 1 1			Cyanide, Total	MG/L as CN	0017210	111	111
					Endrin, Total	UG/L	3 3 3 3 9 0	111	
					Fluoride, Dissolved	MG/L as F	000191510	111	11.1
					Grass Alona, Dissalved	Pe/L	0111510131	111	<u> </u>
		111		1	Gross Beta, Dizalved	Pe/L	0 3 5 0 3	1   1	1   1
		1 1 1	11		Hardness, Total as CaCO <sub>3</sub>	MG/L	0 0 3 0 0	111	111
					Iron, Dissolved	UG/L as Fe	0 1 0 4 5	111	<u> </u>
	XI		X		Lead, Dissolved	UG/L as 25	0 1 0 4 9	111	<u> </u>
	11		11		Lindane, Total	UG/L	3   9   7   8   2	111	
					Manganese, Dissolved	UG/L	0 1 0 5 6		
	प्रा	1 1	1 :	1 1	Mercury Dissalved	UG/L	7 1 8 9 0	111	

UG/L

VALUE CODING RULES AND REMARK CODES ON REVERSE

Mercury, Dissalved

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

#### WATER CUALITY MANAGEMENT ELEMENT

### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYPE O	ia print with Ballpoin	IT PEN			
FACILITY NAM	E UnocalChemic	al _ Carteret, NJ		5W 10 NO. MW-3	
LAB NAMÉ	NANCO Labor	atories- Wappinger Fal	ls. NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LAB CERT, NO.	WOM USE
T N	्व व श ब व ग ग	2 6-0 8 15 15 14 - 2	8 9 0 2 0 7	रा अब हो त	

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0 18 818 TO 018 912 MO. YR.

#### SUBMIT WITH SIGNED T-VWX-014

												SUBMIT WITH SIGNED T.V	V.X-014					59
		54	MP	LIN	G M	401	VT	HS										Ank
ě.	Feb.	Ke.		<b>A</b>	3			Sept	0ci.	No.	Dec.	ANALYSIS	ZTINU	PARAMETER	<b>V A 1</b>	.UE		NEMARKS
$\boxtimes$			$\overline{1}$	T	X	I	Τ		Q			Acrylonitrile	UG/L	3 4 2 1 5		1 2	15	K
				Τ	$\prod$	Π	Ī	$\overline{1}$	Ţ			Senzene	UG/L	3 4 10 13 10		1	15	П
				1	$\prod$		1	1				Bramafarm	UG/L	3 2 1 0 4		11	11	K
			1		$\prod$	Ī	I	T	11			Carbon Tetrachloride	UG/L	3 2 1 0 2		11	!1	K
			Ī		П		T	П	П			Chlarabenzene	UG/L	3 4 3 0 1	111	1.41.	12	
					П	Γ	I	$\perp$				Chlorodibromoethane	UG/L	3 4 3 0:6	-	11	1	K
			T		II	<u> </u>	L		Ī	- 1		Chloroform	UG/L	3 2 1 1 0 1 6	111		11	K
	-		1	!	H		Ī	1!	1			1, 1 - Dichtoroethane	UG/L	3 4 4 9 6	111	11	: 1	K
	Ī						l	Ιj	Ī			1, 2 - Dichtoroethane	UG/L	31415 311		!!	i 1	K
		11			П			11	Ţ	1		1, 1 - Dichlaroethylene	UG/L	314 5:011	111	i I	1	K
	$\Box$				ĪI			1	Ī	Ī		1, 2 · Dichlorograpane	UG/L	3 4 5 4 1	1 1 1		1	K
	Ī				11					1		Ethylbenzene	UG/L	3 4 3 7 1	111	1 1	1	K
	$\top$		:		1!			11	Ī	1		Methylene Chlaride	UG/L	3 4 4 2 3	111	13  8	0	
	1	11		Ī		- 1		$\Pi$	Ī	Ī		1, 1, 2, 2 - Tetrachioroethane	UG/L	3 4 5 1 : 5	! ! !		1	K
		11		Ī	11			П		1		Tetrachigroethylene	UG/L	3 4 4 7:5	111	2	0	
		11	i		11	1			İ	ĺ		Taluene	UG/L	3 4 0 1 1 2	• ;	: ¡1	2	
				ļ	Ţi	_ [		Ш	İ	1		I, 1, 1 - Trichtoroethane	UG/L	31415:016	: ! !	Ī ! :	1	K
	1	11	1	1	11				1	1	$\perp$	1, 1, 2 - Trichloroethane	UG/L	3 4 5 111	1 1 1	<u> </u>	1	K
	1			Ī	II	Ī			Ī	Ī		Trichlaroethylene	UG/L	3 9 1 3:0	1	Hi	1	K
	1	111	Ī	Ī	11				Ī	Ī	I	Vinyl Chlaride	UG/L	3 9 1 1 7 5	i i !	١;	1	K
				Ī	$\prod$	Ī		Ιi	ĺ	1		Acrolein	UG/L	314 2 1 0	· 11	121	5	K
[]]	L	111		Ī	11	$\overline{\perp}$		П		Ι	T	Chlaroethane	UG/L	314 3:111	i ( i	i 9	0	
	1		- 1		H	T				T	Τ	2 - Chlaroemylvinyl Esser	UG/L	3 4 5 7 6	1 1 1	l i	1	K
	I	Hil			11	Ī		<u> </u>		I	I	Dichtoropromomethane	UG/L	3 2 1 1 0 : 5	1   1	1	1	K
	Ī	111	1	T	11	Ī		l i l		1	Ι	1, 3 - Dichloropropylene	UG/L	31461919	1 1 1		1	K
$\prod$	Ī	11!	Ī	1	li	T				T	T	Methyl Bromide	UG/L	3 4 4 1 1 1 3	1 ! !	1	1	K
	T	Hi	- 1	T	П	1	1	11		1		Metnyl Chloride	UG/L	3 4 4 1 1 8	111		1	K
	Ī	11:	1	i	П	1	1	11	_	١	Τ	1, 2 - trans - Dichloroethylene	UG/L	314151415	1 ! ! !		1 ]	K
	Ţ			1	11.	T	Ī	11		I		, 2 Dichtarabenzene	UG/L	314151316	1 1 1	1 1	1	
	Ī	111	İ	1	II	!	i	11		1		, 3 Dichtoropenzene	UG/L	31415:5.5	1 ! !	1	1 []	K
		111	1	1	П	1	Ī	Ī				, 4 Dichtgradenzene	UG/L	3 4 5 7 1	: 1 : 1	1 !		K
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VALUE COOING RULES AND REMARK CODES ON REVERSE

## NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

#### WATER QUALITY MANAGEMENT ELEMENT

FACILITY NAM	Unocal Chemic	als - Carteret, NJ		SW 10 NO.	
LAB NAME		tories Wappingers Fo	alls. NY		
7	NJPOES NO. NJ 0 0 2 6 0 7 7	WELL PERMIT NO.  2 6-0 8 5 5 4 -2	SAMPLE DATE YR.   MO.   DAY   8 9 0 2 0 7	NJ LAB CERT, NO.  7   3   4   6   0    23	WOM USE
THE SCHEOU	ILE INOICATED BELOW IS T	O SE OSSERVED FROM ON BO.	8 8 to 10 18 16 15	J	
		SUBMIT WITH SIGN	ED T-VWX-014		
Sampli	ng months		•		
	医医性性性炎病				

		\$	w	PLI	NC	, M	0	iTh	15					•		VALUE
. 4 4	F.b.	K.	Apr.	Ę	L'a	July	Aus	J		ŭ O	No.	Ď,	ANALYSIS	UNITS	PARAMETER	VALUE
						Π		T	T			Γ	Methoxychlar, Tatal	UG/L	3 9 4 8 0	
П								T	T		ĺ		Methylene Blue Active Substances	MG/L	38250	
П		$\neg$	1				Ī	Π	Ī				Nicrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	0 0 6 0 8	
П								T	T	1			Nitragen, Nitrate Dissolved	MG/L as N	0 0 6 1 8	
П	$\neg$	Ī		j				İ	Ī	1			Odor	T.O.N.	0 0 0 8 5	
	İ		X	1				Π	Ī	I	1		Нс	Standard Units	00400	1   7 .   3   9
	Ī				Ī				T	Ī			Phenois, Total Recoverable	UG/L	3 2 7 3 10	
								!		Ī	Ī		Radium 225, Dissolved	Pc/L	0 9 5 0 3	
	Ī				-			Ī	1	T	I		Radium 228, Dissolved	Pc/L	8 1 3 6 6	
	1	T	Ţ	$\int$					ĺ	T	1		Selenium, Dissalved	UG/L	0 1 1 4 5	
			Ī		Ī					ĺ	1		Silver, Dissalved	UG/L	0 1 1 0 7 5	
	Ī				$\Box$					Ī	Ī		Sadium, Dissolved	MG/L	009301	
		I)	য়	T	Ī				İ		-		Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	0 0 9 4 6	!     !
X	1	!)	$\langle$	T		X			X	1	Ī		Total Dissolved Solids (TOS)	PPM	7 0 3 0 0 1	5 4 5
T	T	1	T		T	Ī	ļ		Γ	T		T	Total Organic Carbon (TOC)	PPM	001618101	
	T	T	Ī		-	T	1				-		Total Organic Halogen (TOX)	UG/L	7 0 3 5 3	
Ī	1	T	T	Ī	1			1		Ī	T	1	Toxagnene	UG/L	3 9 4 0 0 1	11111
	T	T	Ī	T	Ī	T		١		Ī	Ī	1	Turbidity	NTU	00076	
ī	1	1)	1	T	1	1	-	1	-		T	1	Zinc, Dissalved	UG/L	i   0 i e i 0   1   0	
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VALUE CODING RULES AND REMARK CODES ON REVERSE

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#### WATER QUALITY MANAGEMENT ELEMENT

#### GRU ID WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT WITH BALLPOINT JEN ON OI WZ FACILITY NAME Unocal Chemical Carteret N.1 MW-3LAB NAME NANCO Laboratories, Wappingers Falls, NY SAMPLE DATE NJ LAB CERT. NO. WOM USE WELL PERMIT NO. YR. | MO. | DAY NJPOES NO. 2 6 -0 8 5 5 4 - 2 7 3 4 6 0 8 9 0 2 0 7 Я THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 018 818 TO 12 10 12 SUBMIT WITH SIGNED T-VWX-014 NFMANKS SAMPLING MONTHS June July Aug. Sept. ANALYSIS UNITS PARAMETER VALUE ě feet MSL: Elevation of top of well casing with cap off R 8 7 (as specified in well completion report) to nearest .01 feet MSL: Elevation of original ground level q to nearest .01 las specified in well completion report) Depth to water table from top of casing prior to feet: to 8 2 5 4 6 n nearest .01 sampling with cap off Depth to water table from original ground level feet: to 7 2 0 1 9 nearest .01 prior to sampling oli lo la la UG/L as As Amenic, Dissolved 0 1 10 0 5 Barium, Dissolved UG/L 22 3a 0 0 3 1 1 0 Biochemical Oxygen Demand - 5 Day MG/L 0 1 0 2 5 UG/L as Cd Cadmium, Dissolved UG/L as CI 8 2 2 9 5 91 7 9 0 0 Chloride, Dissolved 0 1 0 3 0 Chromium, Dissolved UG/L as Cr 0 1 2 2 0 UG/L as Cr Chromium, Dissolved, Hexavalent MG/L 0 0 3 4 1 Chemical Oxygen Demand (COO), Dissolved 7/4/0/5/6 N/100 ML Caliform Group olololalo P: . Ca Color 0 1 0 4 0 UG/L as Cu Cooper, Dissolved 0 0 7 2 0 MG/L as CN Cyanide, Total 3 9 3 9 0 UG/L Endrin, Total MG/L as F 00950 Fluoride, Dissolved 011503 Pc/L Gross Alona, Dissolved 0 3 5 0 3 Pc/L Gross Beta, Dimolved 0 0 9 0 0 Hardness, Total as CaCO<sub>3</sub> MG/L 0 1 0 4 6 UG/L as Fe Iron, Dissalved 0 1 0 4 9 UG/L as 25 Lead, Dissolved UG/L 3 9 7 8 2 Lindane, Total UG/L 0 1 0 5 6 Manganese, Dissolved

7 1 8 9 0

29 42

40 41

UG/L

VALUE CODING RULES AND REMARK CODES ON REVERSE

Mercury Dissolved

OPERAT	ING EXCEPTIONS DETAILS	<u>.</u>				
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HOURS AT	TENDED AT PLANT					Month Year
	Day of Month	1	2	3	4	5 6 7 8 9 10 11 12 13 14 15 16
	Licensed Operator	$\top$				

Day of Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Licensed Operator	T															
Others																
Day of Month	17	18	19	20	21	22	23	24	25	25	27	28	29	30	31	
Licensed Operator																
Others									Ī				Ī			

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## MONITORING REPORT - TRANSMITTAL SHEET

NIPOES NO.

REPORTING PERIOD

₩Q. Y R.

0:0:2:6:0:7:7

1,1 8,8 THEU 0, 118,9

PERMITTEE:	Unocal Chemical			
	Address 1345 North Meacham I	Road		
	Schaumburg, IL	60196		
FACILITY:	NameUnocal Chemicals Div	vision		
	Address 350 Roosevelt Avenue	3		
	Carteret	(County) Middlesex		
	Telephone <u>1 201 1 541- 4224</u>	•••		
FORMS ATTACH	ED (Indicate Quantity of Each)	OPERATORS EXCEPTIONS		
SLUDGE REPORTS	- SANITARY	j	YES	NO
T-VWX-007	E00-XWV-T 800-XWV-T	DYE TESTONS		$\square$
SLUDGE REPORTS	- INDUSTRIAL	DNIZZATYB YRANCHIST		<b>X</b>
T-VWX-010	A T-VWX-0108	DISINFECTION INTERRUPTION		<b>&amp;</b>
WASTEWATER REP	ORTS	MONTTORES MALFUNCTIONS		<u> </u>
T-VWX-011		UNITS OUT OF OPERATION OTHER		X. X.
GROUNOWATER RE	B) 1 VWX-016 1 VWX-017	(Detail any "Yes" on reverse side in a <del>ppropriate</del> space,)		
NPDES DISCHARGE	монітоя інд я <i>с</i> роят 3320-1	NOTE: The Hows Assended as Plances of this sheet must also be con		te
AUTHENTICATIO	information submitted in this do of those individuals immediately submitted information is true, ac	at I have personally examined and am facument and all amorphisms and that, be responsible for obtaining the information curate and complete. I am aware that the curation including the possibility of fine	ased on on, I bel here are	my inci lieve the signific
LICENSED OPERA	TOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE		
Name (Printed)		Name (Prison) Daryl W. Dierwech Supervisor Environ	ter	
Gerda & Pasisma Na	). <u> </u>	Supervisor Environ Affairs	nmenta	1
Grace & negistry No		Nice printers	H	
Signature		Signature And / Nin	itchn	<del></del>
Date		Date March 21, 1989		

Form VWX Q17

## NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION CESSES RESURCES WATER QUALITY MANAGEMENT ELEMENT

PLEASE TYPE OR PRINT W		OUND WATER ANALYSIS - MON	ITORING WELL R	EPORT	
FACILITY NAME	Unoc			SW 10 NO MW-2	
LAB NAME	NANC	O Laboratories - Wappingers	Falls NY		
N 10 0 5	6 0 7 7	WELL PERMIT NO. YX	AMPLE DATE	1 LAB CERT. NO.	WCM USE
Sampling Month	s	SUBMIT WITH SIGNED T	VW.X-014		n S S
Jan. May. Juna July Sapi.	Der.	ANALYSIS	UNITS	PARAMETER	E AAPRA
X X X	x	Specific Conductance	umhos/cm		1 4 4 5 0

		SAM	PLI	NG	MÇ	INT	HS																	
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x	I	X	I		X			X		I	Specific Conductance	umhos	/cm	Τ	I	Ī					1	4	1   5	0 0
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VALUE CODING RULES AND 46 47 19 40 72 73 REMARK CODES ON REVERSE

Fem YWX-017 4/83 P2

# PER JERSEY DEPARTMENT OF THEMTRARED YESREY ... DIVISION OF MATER RESAUCES WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

7015,	nuari uration	OKCANIC	CO350031
# FASE TYPE OF FRINT MITH BALL MINEY BAN			

FACILITY NA	Me Unocal Chemi	cals - Carteret, NJ		5W 10 NO. MW-2	
LAC AME	NANCO Labora	itories - Wappingers F	alls NY		
<u>.</u>	NJO 0 2 6 0 7 7	2 6 -0 8 5 5 3 -4	TR.   MO.   DAY 89   0 2 0 7	7 3 4 6 0	WCM LEET

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 1018 818 TO 18 19 12

#### SUBMIT WITH SIGNED T-YWX-014

SUPPLING MONTHS				ž.
11111111111	AMALYEE	UNITE	PARAMETER	AVTA P
	Chrysene	ug/l	3 4 3 2 0	
	Dibenzanthracene	ug/1	3 4 5 5 6	
	1,2-Dichlorobenzene	ug/1	3 4 5 3 6	
	1,3-Dichlorobenzene	ug/1	3 4 5 6 6 1	
	1.4-Dichlorobenzene	ug/l	3 4 5 7 1	
	3,3'-Dichlorobenzidine	ug/1	3 4 6 3 1	
	Diethyl Phthalate	ug/1	3 4 3 3 6 1	
	Dimethyl Phthalate	ug/l	3 4 3 4 1	
	Di-n-butyl Phthalate	ug/1	39110	
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1	
	2,6-Dinitrotolulene	ug/l	3 4 6 2 6	
	Di-m-octyl Phthalate	ug/l	34596	
	1.2-Diphenylhydrazine	ug/1	3 4 3 4 6	
	Fluoranthene	ug/1	3 4 3 7 6	
	Fluorene	ug/1	3 4 3 8 1	
	Eexachlorobenzene	ug/1 ·	3 9 7 0 0	
	Hexachlorobutadiene	ug/1	3 4 3 9 1	
	Bexachlorocyclopentadiene	ug/l	3 4 3 8 6	
	Rexachloroethane	ug/1	3 4 3 9 6 1	
	Indenopyrene	ug/1	3 4 4 0 3 1	
	Isophorone	ug/1	3 4 4 0 8	
	Haphthalene '	ug/1	3 4 6 9 6	
	Mizzabenzene	uz/1	34447	
	H-Missandimentlyanine	uz/1	34438	
	N-Nitrosodi-n-probylsmine	ug/1	3 4 4 2 8 1	
	N-Mitrosodiphenylamine	ug/1	3 4 4 3 3 .	
	Phenanthrene	- ug/l	3 4 4 6 1	
	Рутеле	ug/1	3 4 14 16 19	
	1,2,4-Trichlorobenzene	ug/1	B 4 5 5 1	
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VALUE CODING RULES AND REMARK CODES ON REVERSE Form YMX-017 6/83

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VALUE CODING RULES AND

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

### GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYP	E OR PRINT MITH BALLPOIN	TPEN		15W 10 NO.	
FACILITY A	Unoc3	1 Chemical - Carteret,	NJ	MW-2	
LAS HAME	- NANCO Labora	tories - Wappingers Ea	ills NY	···	
Ō	N. 0 0 2 6 0 7 7	26-08553-4	EAMPLE DATE TE.   MO.   DAY 8 9 0 2 0 7	7 3 4 6 Q	MCM CET

THE SCHEDULE INDICATED SELOW IS TO SE OSSERVED FROM 18 18 18 TO 108 190

SUBHIT WITH SIGNED T-FWX-014 eampling months UNITE PARAMETER VALUE AKALYES 14 | 5 | 8 | 6 ug/1 2-Chlorophenol ug/1 3/4/6/0/1 2.4-Dichlorophenol 14 6 0 6 2,4-Dimethylphenol ug/1 7 7 6 0 3 ug/1 . 2,6-Dimitro-o-cresol ug/1 2.4-Dimitrophenol 14151911 ug/1 2-Mitrophenol 3 4 6 4 9 ug/I··· 4-Nitrophesol 3 4 4 4 5 1 2 ug/l p-Chloro-s-cresol ug/l 3 9 0 3 2 Pentachlorophenol ug/1 4 6 9 5 Phenol ug/l 2,4,6-Trichlorophenol uz/1 A - a - a - b - b - a - b 3 4 2 0 0 ug/1 Acenaphthylene ug/1 3 4 2 2 0 Anthracene 3 9 1 2 0 ug/1 Benzidine 3 4 5 2 6 ug/1 Benzanthracene 3 4 2 4 7 ug/1 Benzapyreae 3 4 2 3 10 ug/1 3.4-Benzofluoranthene 3 4 5 2 1 uz/1 Benzoberylene 3 4 2 4 2 ug/1 Benzofluoranthene 3 4 2 7 8 ug/1 Bis(2-chloroethoxy)methane 3 4 2 7 3 ug/1 Bis(2-chloroethyl) Ether 3 4 2 8 3 ug/1 Bis(2-chlroisopropy1) Ether ug/1 3 9 1 0 0 Bis(2-ethylhexyl) Phthalate 3 4 6 3 6 4-Bromophenyl Ether ug/1. ug/1 3 4 2 9 2 Butylbenzyl Phthalate 3/4/5/8/1 uz/1 7-Chin-chanhehalene

4-Chlorophenyl Phenyl Ether

3 4 6 4 1 1

22 24

40 41

ug/1

## POTTOTTORS ATMINAMENDALOR OF THE PRACESC VECEL WEN PO MOISINIO SECRET AND MOISINIO

WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYPE OF ?	rint with Ballpoint PEN	
FACILITY NAME	UnocalChemical _ Carteret, NJ	SW 10 NO. MW-2
LAB NAME		

NANCO Laboratories - Wappinger Falls, NY

NIPOES NO. T

WELL PERMIT NO. 26-085534

SAMPLE DATE YR. | MO. | DAY 8 9 0 2 0 7

... LAS CERT. NO.

EZU MDW

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 18 88 TO 18 91 2 NO. YR.

#### SUBMIT WITH SIGNED T-VWX-014

	SAMP	-					_					
F. B.	Àp.	۲ م د م	7	Aut	Sept	Oct.	Š.	Dec.	ANALYSIS	UNITS	PARAMETER	VALUE
1	X	T	X			X			Acrylonitrile	UG/L	3 4 2 1 1 5	1
T	III	Τ	11!			T	<u> </u>	Π	Benzene	UG/L	3 4 0 3 0	114
	111	T	111			T.		<u> </u>	Bromotorm	UG/L	3 2 1 1 0 4	1
	H	T	$\Pi$						Carbon Tetrachtoride	UG/L	3 2 1 0 2	1
TT	111	1		Ī		T			Chlorobenzene	UG/L	3 4 3 0 1	
11	TII	T	111		T	H			Chlorodibromoethane	UG/L	3 4 3 0:6	1
	HI	T	111		Ī	П			Chloroform	UG/L	3 2 1 1 0 6	1   1   11
	111	!	111	ī	ī	!!		$\neg$	1, 1 - Dichtoroethane	UG/L	3 4 4 9 6	1   1   11:9
	111	1	H	T	Ī	11	-		1, 2 - Dichtoroethane	UG/L	3 4 5 3 1	1 1 1 1 1 1
	111	1	H	T	-	<u>T!</u>		一	1, 1 - Dichloroethylene	UG/L	3 4 5 0 1	11161.18
		1 1	11		T	11	ļ	_	1, 2 - Dichlorograpane	UG/L	3 4 5 4 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	111		11	Ī	١	11	_}		Emylbenzene	UG/L	3 4 3 7 1	
	11:		1!	1	Ī	11	1	П	Methylene Chloride	UG/L	3 4 4 2 3	1
111			1!	1	1	П	1	$\neg$	1, 1, 2, 2 - Tetrachiorpemane	UG/L	3 4 5 1 5	1 1 1 1 1 1
	TI		11	Ī	1	П	Ī	1	Tetrachioroethylene	UG/L	3 4 4 7:5	
	Ti		11	1	- ;	ΪĪ	Ī	丁	Taluene	UG/L	3 4 0 1 2	11.3
1 :	11	1	11	Ī	-	П	Ī		1, 1, 1 - Trichloroethane	UG/L	3 4 5 : 0 : 5	
11	TT I	1 1	11	Ì	ı	1	1	$\dashv$	1, 1, 2 · Trichloroethane	UG/L	3 4 5 1 1	1 1 1 1 1 1
11			H	Ť	T	П	1	1	Trichlaroethylene	UG/L	3 9 1 3:0	
11	11	1	Ìι	Ť	Ť.	11	Ť	1	Vinyl Chloride	UG/L	3 9 1 7 5	i !   i : 1
<del>- i i</del>			Ť	Ť	İ	1	Ť	$\top$	Acrolein	UG/L	314 2 1 1 0	11:12:5
<u> </u>	111	i	H	i	1	Ϊ́	ì	十	Chloroethane	UG/L	314 3:1,1	1 i i i 1
市市	111	i	ii	i	1	Ιİ	i	$\dagger$	Z - Chloroemylvinyl Emer	UG/L	3:4 5.7.6	1 1 1 1 1
1 1		1	<del>     </del>	Ť	Ť.	i	<del>-</del>	<del>-</del> +	Dichloropromomethane	UG/L	3 2 1 0:5	:       1
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1 1		<del>-</del>	11	1	<u> </u>	H	÷	+	Mesnyl Chlance	UG/L	3 4 4 1 8	1     1   1
1 1	1: 1		11	+	<del> </del>	+	÷	+	1, 2 - trans - Oignlorgethylene	UG/L	3 4 5 4 5 1	1 1 1
$\dot{-}\dot{-}$	1 1	$\dashv$	++	÷	+	i	÷		1, 2 Oichtgrabenzene	UG/L	314151315	1111
++	111	<del>-                                    </del>	<del>;;</del>	+	<u> </u>	÷	+	_	1, 3 Dichtoropenzene	UG/L	31415:5:5	1 1 1 1
1 1	+ 1 1	÷	<del></del>	Ť	÷	÷	Ť	<del></del>	1, 4 Dichtgragenzene	UG/L	314151711 1	1:11:11
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VALUE COOING RULES AND REMARK CODES ON REVERSE

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

PL S	EASE	TYPE OR	PRINTWITH	BALLPOINTPEN	

FACILITY NAM	Unocal Chemi	cals - Carteret, NJ		SW 10 NO.	
DMAN BAJ		atories, Wappingers A	Falls, NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT, NO.	
S	0 0 2 6 0 7 7	2 6 0 8 5 5 3 4	8 9 0 2 0	7   3   4   6   0	MOW UZE

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0 18 88 TO 08 912

#### SUBMIT WITH SIGNED T-VWX-014

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٠_٢		Ker.	Apr.	May	June	July	Aug.	25.	0c1.	Nov	0	ANALYSIS	UNITS	PARAMETER	VALUE .
												Methaxychlor, Total	UG/L	3 9 4 8 0	
L		1		1					Ī	L		Methylene Blue Active Substances	MG/L	38250	
L												Nitrogen, Ammonia, Dissolved NH3 + NH4 as N	MG/L as N	0 0 6 0 8	
												Nitragen, Nitrate Dissolved	MG/L as N	0 0 6 1 8 1	
												Odor	T.O.N.	0 0 0 9 5 1	
			$X_1$	$\Box$		Ī						эН	Standard Units	0 0 4 0 0 1	171.1013
			$\perp$	1							Ī	Phenois, Total Recoverable	UG/L	3 2 7 3 10 !	1   ! ! !
			Ī									Radium 225, Dissolved	Pc/L	0 9 5 0 3	
			I	$\Box$	-			1				Radium 228, Dissolved	Pe/L	8 1 3 6 6	
						-		-		-		Selenium, Dissolved	UG/L	0 1 1 4 5	1111
П		T	1				Ī			-		Silver, Dissalved	UG/L	0 1 0 7 5	
П		1	T		1		1	Ī		1		Sadium, Dissalved	MG/L	0 0 9 3 0	
П	Ī		₹	T	Ī		Ī	I				Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	0101914 6 1	1111
X	Ī	!>	(	1	T)	1	Ī	T)	X	-		Total Dissolved Solids (TDS)	PoM	7 0 3 0 0 1 1	9 1 8 6
	Ī		1	Ī	Ī	T	Ī	T	Ī	-		Total Organic Carbon (TOC)	РРМ	0 0 6 8 0 1 1	
		1	T	Ī	ļ	1	Ī	T	1	Ī		Total Organic Hallogen (TOX)	UG/L	7 0 3 5 3 1	
T	Ī	T	T	T	Ī	T	Ī	Ī	Ī	T	٦	Toxionene	UG/L	394001	1111
T	T	T	T	T	Ī	T	T	T	Ī	Ī	1	Turbidity	NTU	0 0 0 7 6 1	
j	Ī	īX	1	Ţ	Ī		Ī	I	1	T	寸	Zinc, Dissolved	UG/L	011091011	
T	1	Ī	Ī	Ī	Î	Ī	Ī	T	ī	Ī	7	2, 4-0, Total	UG/L	3 9 3 7 0 1 1	11111
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i	†	÷	· I		<del> </del>	<del>i</del>	<u> </u>	†	<u> </u>	i	+				
<u> </u>	<u> </u>	<del>'</del> -	<u>'</u>		<u>'</u> _		<u>-</u>	<u>'</u> _	<u>'</u>	<u>.</u>				29 33 34	+9

VALUE CODING RULES AND REMARK CODES ON REVERSE

## W JERSEY DEPARTMENT OF THEMTALFEC YESEEL W CONTRACTOR TO MOIZIVIO

#### THEMELE THEMES AND PAIL OF THE

#### GRU ID WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OF PRINT WITH BALLPOINT YEN ON OI WE. FACILITY NAME Unocal Cheminal Carteret, M. MW-2 WAN EN NANCO Laboratories, Wanningers Falls, NY SAMPLE DATE NJ LAB CERT, NO. WCM USE YR. | MO. | DAY NJPOES NO. 8 9 0 2 0 7 1 d 85 5 3 R 7 3 4 6 0 THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 18 18 TO 18 97 SUBMIT WITH SIGNED T-VWX-014 SAMPLING MONTHS 4 À. ANALYSIS UNITS PARAMETER VALUE No. Set Elevation of top of well casing with cap off feet MSL: las specified in well completion report) to nearest .01 Elevation of original ground level feet MSL: 4 (as specified in well completion report) to nearest .01 Depth to water table from too of casing prior to feet: to 8 2 5 4 6 nearest 01 0 Ho can wim can off Depth to water table from original ground level feet: to 7 2 0 1 9 6 prior to sampling nearest .01 UG/L as As Amenic, Dissolved 0 | 1 | 0 | 0 | 0 0 1 0 0 5 UG/L as Ba Barium, Dissolved MG/L 0 0 3 1 1 0 Biochemical Oxygen Demand - 5 Day UG/L as Cd 0 1 0 2 5 Cadmium, Dissolved 8 2 2 9 5 UG/L as CI 15101 3 Chlorice, Dissolved UG/L as Cr 0 1030 Chromium, Dissolved UG/L as Cr 0 1 2 2 0 Chromium, Dissolved, Hexavalent 00341 MG/L Chemical Oxygen Demand (COO), Dissolved N/100 ML 7 4 0 5 6 Caliform Group Calar Pt - Ca olalalala 0 1 0 4 0 UG/L as Cu Capper, Dissolved MG/L as CN 00720 Cyanide, Total UG/L واداوادا Endrin, Total MG/L as = 0 0 9 5 0 Fluoride, Dissolved 0 1 1 5 0 1 3 Pc/L Grass Alana, Dissalved Pc/L 0 3 5 0 3 Gross Beta, Dissolved Hardness, Total as CaCO, 0 0 9 0 0 MG/L 0 1 0 4 6 UG/L as Fe Iran, Dissalved 0 1 0 4 9 UG/L as 25 Lead, Dissolved UG/L 3 9 7 8 2 Lindane, Total 0 1 0 5 5 UG/L Mancanese, Dissolved

7 1 8 9 0

29

33 24 46 47

UG/L

VALUE CODING RULES AND REMARK CODES ON REVERSE

Mercury, Dissaired

## MONITORING REPORT - TRANSMITTAL SHEET

NUPDES NO.

REPORTING PERIOD .

₩Q. YR.

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111818 THE [011 | 819]

		<del></del>		
PERMITTEE:	Mnocal Chemical			
	Address 1345 North Meacham	Road		
	Schaumburg, IL	60196		
FACILITY:	Name Unocal Chemicals Di	vision		
	Address350 Roosevelt Avenu	re		
	Carteret	(County) Middlesex		
	Telephone <u>1 201 ) 541- 4224</u>	•••		
FORMS ATTACH	HED (Indicate Quantity of Each)	OPERATURE EXCEPTIONS		
SLUOGE REPORTS	S - SANITARY		YES	NO
T-VWX-00	7 T-VWX-COB T-VWX-COG	DYETESTOIG.		abla
SLUDGE REPORTS	- INOUSTRIAL	DNIZZASYB YRANCEGET		
T.VWX-016	BDIO-XWV-T	DISIMPECTION INTERRUPTION		<b>&amp;</b>
WASTEWATER RE	PORTS	MONTTORDEG MALFUNCTIONS		<u> </u>
T-VWX-011	T-VWX-012 T-VWX-013	UNITE CUT OF OPERATION OTHER		<b>X</b>
GROUNOWATER R	EPORTS .B) 1 VWX-016 1 VWX-017	(Detail say "Yes" on reverse side in a <del>ppropriate</del> space.)		
NPOES DISCHARGE	13320-1	NOTE: The "Hows Attended at Plane of this sheet must also be con		ie
AUTHENTICATIO	information submitted in this do of those individuals immediately submitted information is true, ac	at I have personally examined and am facument and all attachments and that, be responsible for obtaining the information curate and complete. I am aware that the complete in the possibility of fine possibility of fine possibility.	ased on a on, I bei there are	my inquieve the significa
LICENSED OPERA	ATOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE	i.	
Name (Printed)		Name (Avisor) Daryl W. Dierwecht Supervisor Environ	ter	
Grade & Registry N	o	Supervisor Environ Affairs	nmenta)	<u> </u>
		Signature Nay 10 VI	intel	<u>ta</u>
Date		Date March 21, 1989		

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

FACILITY	NAME Unocal	Chemicals - Carteret.	NJ	SW 10 NO MW-3	
MAN BA		Laboratories - Wapping			
ń	NJ0 0 2 6 0 7 7	WELL PERMIT NO. 2 6 0 8 5 5 4 2	SAMPLE DATE YR.   MO.   DAY   8 9 0 2 0 7   17 22	NJ LAB CERT. NO.	WCM USE
THE SCHE	EDULE INDICATED SELOW IS T	D SE OBSERVED FROM 0 18 8			

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Jan.	<b>S</b> 4		Net.						;	¥ 04.	Dec.						4	ANA	<b>LLY</b>	'S1 <b>S</b>								L	INIT	5		P.4	RA	ME	TE	R			v	AL	U€			DEMANYS	H. Maria
x	7	<u>(  </u>	T	7	<u>. T</u>	1		x	Ī			Sp	e	:i	fi	د ر	<u>c</u> -	ndı	uc	can	ce						u	nh	os,	/cɪ	n									Γ	17	8	5		
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Fem YWX-017 4/83 P2

## NEW JERSEY DEPARTMENT OF THEMTRAPSO PERSECT ! DIVISION OF WATER RESOURCES WATER DIALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYP	E OR PRINT WITH BALLPOIN	T PEN			
FACILITY N	unocal Chem	icals - Carteret, NJ		SW 10 NO. MW-3	
LAE SME	NANCO Labor	atories - Wanningers F	alls. NY		
•	AUFOLI NO.	WILL PERMIT NO.	SAMPLE DATE . YR.   MO.   DAY	NJ LAS CERT, NO.	THOM USE
Ō	4499499	26 08554	890207	2131416101	

THE SCHEDULE INDICATED BELOW IS TO BE OSSERVED FROM [0,88,8] TO [0,89,2]

SUBMIT WITH SIGNED T. PWX-014

AMALYEE    Martin   M	PERARE
Chrysene	
1.3-Dichlorobenzene ug/1 3 4 5 6 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
3.3'-Dichlorobenzidine ug/1 34631	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	$\prod$
Diethyl Phthalate   ug/l   3 4 3 3 6	
Dimethyl Phthalate   ug/1   3 4 3 4 1	1 1 1
	$\sqcap$
	$\prod$
	$\prod$
Di-p-octyl Phthalate   ug/1   3 4 5 9 6	$\prod$
	$\prod$
Hexachlorobenzene ug/1 39700	
Hexachlorobutadiene ug/1 3 4 3 9 1	
Hexachlorocyclopentadiene ug/1 34386	
Isophorone ug/1 34408	
Missabensens Ug/1 34447	$\perp$
H-Wieragedino-elyanine 27/2 3 4 4 3 9	
N-Mitrosodiphenylamine ug/1 3 4 4 3 3 .	
Phenanthrene - ug/1 3 4 4 6 1	
Pyrene ug/1 3 4 4 6 9 1 1	
1.2.4-Trichlorobenzene ug/1 3 4 5 5 1	40 41

VALUE CODING RULES AND REMARK CODES ON REVERSE

Ferm VWX-017 URS P1

VALUE CHOING RULES AND

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID. BASE/HEUTRAL ORGANIC COMPOUNDS

PLEASE TY	PE OR PRINT WITH SAL	LPOINT PEN		EN ID NO.	
FACILITY	MAME (	inocal Chemical - Carteret	, NJ	MW-3	
LAS HAM	- NANCO La	boratories - Wappingers E	alls NY		
미	NJ-0 0 2 6 0 7	WELL PERMIT NO.	TE.   MO.   DATE	NI LAB CERT. NO.	MCM CEE

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 1018 818 TO 10 40 12

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	4	₹	į.	<b>;</b> .	<b>.</b>	Ţ	; }	ď.	Ĭ	ź	\$	Ź	ANALYES	UNITS	PARAMETER	VALUE	=
Ţ	$\overline{}$	ì		रो	T	Ì	T	Ì	$\tilde{\Box}$	Ž	Ī	Ī	2-Chlorophenol	ug/1	3 4 5 8 5	<del>!                                    </del>	-
ł	寸		Ť	1	十	†	+	7		_			2.4-Dichlorophenol	ug/1	3 4 6 0 1	<del>! ! ! ! ! !</del>	
ł	$\dashv$	ᅥ	十	+	$\dagger$	†	+	7		:	Г		2,4-Dimethylphenol .	ug/1	3 4 6 0 6	<del>                                     </del>	- -
ł	+	ᅥ	十	+	十	†	+	7		1			2,6-Dimitro-o-cresol	ug/1 ·	- 7 7 6 0 3	<del>!                                    </del>	$\bot$
ł	┪	┪	十	1	$\dagger$	†	+	7			Г	$\sqcap$	2,4-Dinitrophenol	ug/1	3 4 6 1 6	<del>!                                    </del>	+
ł	+	7	+	1	十	†	$\dagger$	1		1		П	2-Nitrophenol	ug/1	3 4 5 9 1		+
H	╅	ᅥ	十	+	$\dagger$	†	+	i	7	Ī		П	4-Nitrophenol	ug/I··	3 4 6 4 9	<del>!                                    </del>	_
ł	$\dashv$	┪	╅		Ť	†	$\dagger$	i	Ť	!	Т	İ.	p-Chloro-2-cresol	ug/l	3 4 4 5 2	<del>! ! ! ! ! !</del>	_
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1	$\dashv$	┪	÷	;	十	t	$\dagger$	┪	_		<u> </u>	П	2,4,6-Trichlorophenol	ug/1	3 4 6 2 1	<u> </u>	
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ł	+	_	+	+	+	+	十	┪	<del>-</del>	-	 		Acenahahana	uz/1	3/4/2/0/5	11111	1
ł	$\dashv$	_;	+	+	╁	+	十	<del>-</del>	1	:	<del> </del>		Acenaphthylene	ug/1	3 4 2 0 0	<u> </u>	$\bot$
lł	$\dashv$	ᅥ	十	<del>:                                    </del>	十	t	╁	1		1	i	İ	Anthracene	ug/1	3 4 2 2 0	<u> </u>	$\bot$
ł	ᆉ		╁	÷	十	÷	÷	-		<u>.</u>	H	i	Benzidine	ug/l	3 9 1 2 0	<u> </u>	$\bot$
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1	4		$\dashv$	╁	÷	╁	$\dashv$	_		_	<del> </del>		3,4-Benzofluoranthene	ug/1	3 4 2 3 0	<u> </u>	<u> </u>
ı			十	+	+	t	Ť	_	i	1			Benzoperylene	ug/1	3 4 5 2 1	<u> </u>	$\perp$
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ı	-	-	$\dashv$	+	÷	+	╁	╣		_	-		Bis(2-chloroethyl) Ether	ug/l	3 4 2 7 3	<u> </u>	$\bot$
Į	+	-	$\dashv$	+	+	+	+	-		_	<del> </del>		Bis(2-chlroisopropyl) Ether	ug/l	3 4 2 8 3		
ł	+		+	+	+	+	+	닉	-		<del> </del>		Bis(2-ethylhexyl) Phthalace	ug/1	3 9 1 0 0	<u> </u>	_
ł	-+	!	+	+	+	+	+	<del>-</del>	┪	_	-	$\exists$	4-Bromophenyl Ether	ug/1.	3 4 6 3 6		_
1	-	-	+	+	+	+	+	-{	ᆉ	_	_	$\vdash$	Butylbenzyl Phthalate	ug/l	3 4 2 9 2		4
ŀ	$\dashv$	-¦	+	+	+	+	+	ᆉ	ᆛ		-	$\vdash$	2-Chloronaphshalene	uz/1	3/4/5/9/1	<u> </u>	+
ł	+	{	+	+	+	+	+	┪	$\dashv$	_	-	Н	4-Chioraphenyl Phenyl Ether	ug/l	3 4 6 4 1 1		0 41
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OPERATING EXCEPTIONS DETAILED					
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HOURS ATTENDED AT PLANT		Month L	Year L		

Day of Month	1	2	3	4	<u> </u>	5	7	8	9	10	11	12	13	14	15	16
Licensed Operator																
Others																
Day of Month	17	18	19	20	21	22	23	24	25	25	27	28	29	30	31	
Licensed Operator																
Others																

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## NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

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									G	ROUND WATER ANALYSIS - MONITOR	RING WELL R	EΡ	0	R	Γ								
					PIN	T 14	11 T h	, 9	اعدد	LPOINT PEN				<u> </u>									
[ ]	ACIL	(TY :	W.A.P	E	1	Ŭ'n	oc.	<b>a</b> !	. c	hemicals - Carteret, NJ		3,			•••	M	W-	4					
	N 8 A	AME								ahoratories, Wappingers Falls, NY	EOATE					_							_
					,	418	06:	3 P	10.		E DATE 10.   DAY	LN	u	8	CE	A.	T, N	a.			wa	M US	
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										SUBMIT WITH SIGNED T- PWX	-014												
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			П	T	T	T	Τ	T	$oxed{\mathbb{L}}$	Methaxychior, Total	UG/L	3		9	4	8	0			$\perp$		11	
Г	П	1			T	T	T	L	T	Methylene Blue Active Substances	MG/L	]3	1	8	2	6	lo	Ш		$\perp$		11	
	П	Т	П	1	T	T	T	T	T	Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	0	1		6	ļo	8				$\perp$		$\perp$
		T	Π	T	T	Τ	T	T	T	Nitragen, Nitrate Dissolved	MG/L as N	0	1	0	6	1	8						
	П	T		T	T	T	T	T	T	Odar	T,O,N,	0	1	ا د	o!	8	5					$\Pi$	
	1	ĪΧ		Ĩ	ī	Ī	ī	Г	T	эн	Standard Units	0	To	3	4	0	0			1	71.	lole	5
	П	1		T	T		T	Ī	T	Phenois, Total Recoverable	UG/L	3	1:	2	7	3	10	$\Box$	ı	I	-	<u> </u>	T
H			T	T	Ť	İ	Ť	T	Ť	Radium 225, Dissolved	PciL	0	Is	3	5	0	3	П	ī	Ī	T	11	T
H	ΪŤ		Ť	Ť	Ť	Ť	Π	T	Ť	Radium 229, Dissolved	P=/L	8	1	i Į	3	6	6	Π	Ī	T	T	l i	T
H	$\Box$	T	Ť	Ť	İ	Ī	İ	<u>;                                     </u>	T	Selenium, Dissalved	UG/L	0	1	ı	1	4	5	Π	T	T	T	Πi	T
H	Ϊİ	Ť	Ť	Ť	İ	<del>i</del>	$\Box$		Ť	Silver, Dissalved	UG/L	0	į	1	0	7	5	!	Ţ	T	1	11	
H	$\dot{}$	ii	Ť	Ť	<del>i</del>	T		İ	Ť	Sadium, Dissalved	MG/L	0	0	1	9	3	! o	Ī	$\overline{1}$	T	T	11	
		1 1			•	٠	<u>.                                    </u>	_		<u></u>		+-	_	÷	<del></del>			_	<del>-</del>	<del></del> -			+-1

<u> </u>	Methylene Blue Active Substances	MG/L	[3 8 2 6 0
	Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	0 0 6 0 8
	Nitragen, Nitrate Dissolved	MG/L as N	0 0 6 1 8
	Odor	T.O.N.	0008511111
	эн	Standard Units	0 0 4 0 0 1 1 7 1 0 6
	Phenois, Total Recoverable	UG/L	3 2 7 3 10 ! ! ! ! !
	Radium 225, Dissolved	Pc/L	0 9 5 0 3
	Radium 228, Dissolved	Pt/L	8 1 3 6 6 1 1 1 1
	Selenium, Dissolved	UG/L	0 1 1 4 5
	Silver, Dissalved	UG/L	0 1 0 7 5
	Sadium, Dissalved	MG/L	
	Sulfate, Dissolved (as SO <sub>4</sub> )	MG/L	0 0 0 9 4 6
XIXIXIX	Tatal Dissalved Salids (TDS)	29M	7 0 3 0 0 1 1 4 8 3
	Total Organic Carbon (TOC)	Pa4V	0 0 0 5 8 0 1 1 1 1 1
	Total Organic Halogen (TOX)	UG/L	7 0 3 5 3 1 1 1 1 1
	Taxachene	UG/L	3 9 4 0 0 1 1 1 1 1
	Turbidity	טדא	0 0 0 7 5 1 1 1 1 1
	Zinc, Oissaived	UG/L	01109011111
	2, 4-0, Total	UG/L	3 9 3 7 0 !
	2, 4, 5—TP, Total	UG/L	3 9 0 4 5
<u> </u>			29 11 14 40 4

VALUE COOING RULES AND REMARK CODES ON REVERSE

## M JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION OF WATER RESOURCES

#### WATER QUALITY MANAGEMENT ELEMENT

#### GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT WITH SALLPOINT . 'EN

FACILITY N	Unocal Chear	tal Carteret N.1		SW 10 NO MW-4	
BALM BA	_	s. Wappingers Falls,	YY		
	NIPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT, NO.	WOM USE
R	ulqqqqqyi	26-01851515-1	8 9 0 2 0 7	7 3 4 6 0	

THE SCHEDULE INDICATED SELOW IS TO 3E OBSERVED FROM 0. 18 8 8 TO 0 8 9 12 MO. YE.

	SUBMIT WITH SIGNED T-VWX	-014		
sampling months				
Met. Met. Met. Met. Met. Met. Met. Met.	ANALYSIS	צדואט	PARAMETER	VALUE
MIMIMIMI	Elevation of top of well casing with cap off (as specified in well completion report)	feet MSL: to nearest .01		8 6 8
MIMIMIM	Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01		9.30
MIXIXIMI	Depth to water table from top of casing prior to sampling with cap off	feet: to nearest .01	8 2 5 4 6	2.67
MIMIMIMI	Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	3.29
	Arsenic, Dissolved	UG/L as As	011000	111111
	Sarium, Dissolved	UG/L as 3a	0 1 0 0 5	111111
	Biochemical Oxygen Demand - 5 Day	MG/L	0 0 3 1 0	
	Cadmium, Dissolved	UG/L as Cd	0 1 0 2 5	
MINIMIN	Chlorice, Dissalved	UG/L as CI	8 2 2 9 5	4 8 9 0 0
	Chromium, Dissolved	UG/L as Cr	011030	
	Chromium, Dissolved, Hexavalent	rtæ/r sr Ci	0 1 2 2 0	111111
	Chemical Oxygen Demand (COD), Dissolved	MG/L	0 0 3 4 1	
	Caliform Group	N/100 ML	7 4 0 5 6	
	Calar	Pt - Ca	00001810	11111
	Capper, Dissalved	UG/L as Cu	0 1 0 4 0	
	Cyanide, Total	MG/L as CN	0 0 0 7 2 0	
	Endrin, Total	UG/L	3 9 3 9 0	
	Fluande, Dissalved	MG/L as F	0 0 9 5 0	1111111
	Gross Alona, Dissolved	Pc/L	0 1 5 0 3	
	Gross Beta, Dimolved	Pc/L	0 3 5 0 3	
	Hardness, Total as CaCO <sub>3</sub>	MG/L	0 0 9 0 0	
	Iran, Oissalved	UG/L as Fe	0   1   0   4   6	
	Lead, Dissolved	UG/L as 25	0 1 0 4 9	
	Lindane, Total	UG/L	3 9 7 8 2	
	Manganese, Dissolved	UG/L	0 1 0 5 5	
	Mercury, Dissalved	UG/L	7 1 1 8 9 0	
			13 14	40

VALUE CODING RULES AND REMARK CODES ON REVERSE

## NO:TOSTOPPARAMINENDALVAR DE TRAVERACES VEREL WEND AD MOISIVIO WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYPE	e or print with Ballpoin	it pen			
FACILITY NA	unocalChemic	al _ Carteret, NJ		50 10 NO. MW-4	
عسده فس	NANCO Labor	atories- Wappinger Fal	ls. NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR. ; MO.   DAY	LAS CERT, NO.	WOM USE
Ţ	un d d s e d z z	518-082241	8 9 0 2 0 7	7 3 4 8 7	25

THE SCHEDULE INDICATED SELOW IS TO SE DESERVED FROM 0. YR. TO 018 912

#### SUBMIT WITH SIGNED TOWNSOIS

														-	SUBMIT	WITH S	IGNED I	- PW.	·014											S
		S	M	PLI	NC	. M	101	NT	745	•																				A D X
Jan.	Feb.	¥.	Apr.	MeY	Pun.	7		4	Sept	0 <u>e</u> i.	N		2		ANALY	SIS			דואט	•	PA	RAI	HET	£A		•	/AL	JE		NEMANKS
X			X			X	T	T	7	$\nabla$		Τ	Acrylon	trile					UG/L		3	4	2   1	5			I		2 5	K
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	7	11	i	1	Ī	11	ī		Πi	ī	1		1.3 · Die	loropro	gylene		**		UG/L		314	16	91	9	i	Ī	1	11 (	010	K
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REMARK CODES ON REVERSE

## MONITORING REPORT - TRANSMITTAL SHEET

NIPOES NO.

REPORTING PERIOD "

0101216101717

11188 THE [0:118:9]

PERMITTEE:	Mancal Chemical			
	Address 1345 North Meacham	Road		
	Schaumburg, IL	60196		
FACILITY:	NameUnocal Chemicals Di	vision		
	Address350 Roosevelt Avenu	ρ		
	Carteret	(County) Middlesex		
	Telephone <u>1 201 1 541- 4224</u>	****		
FORMS ATTACH	ED (Indicate Quantity of Each)	OPERATORS EXCEPTIONS		
SLUDGE REPORTS	· SANITARY		YES	NO
T-VWX-007	eco-xwv-t 800-xwv-t	DYETESTONS		$\nabla$
SLUDGE REPORTS	· INOUSTRIAL	DIEZARYB YRANGEST		
T-VWX-010	A T-VWX-0108	DISINFECTION INTERRUPTION		abla
		MORTIDRES MALFUNCTIONS		
WASTEWATER REP		UNITS OUT OF OPERATION		
T-VWX-011	T-VWX-012 T-VWX-013	ОТНЕЯ		
GROUNOWATER RE	(B) 1 VWX-016 1 VWX-017	(Dettil my "Yes" on reverse side in <del>appropriate</del> spece.)		
	MONITORING REPORT			
EPA FORM		NOTE: The "Hours Assended at Plane of this sheet must also be con		ie.
AUTHENTICATIO	of those individuals immediately submitted information is true, ac	at I have personally examined and am facument and all attachments and that, but responsible for obtaining the information curate and complete. I am aware that the possibility of finding the possibility of finding the possibility of finding the possibility.	ased on a on, I bel here are	my inquieve the significa
LICENSED OPERA	TOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE		
Name (Printed)		Name (Prices) Daryl W. Dierwech Supervisor Environ	ter	
Grade & Registry No	),	Title (Primer) Affairs	menta.	L
		Signature Dint 1	wett.	
Dete		Date March 21, 1989		

#### NOITE STORY LATINAMNORIVE OF TRAVTRACED YESRAL WAN CEDRUCES AST WAS NO NOISIVED TRAMED TRAMEDAMAM YTILAUD RATAW

	C	GROUND WATER ANALYSIS - MONITO	ORING WELL R	EPORT	
	JEE HTIW THIPS AD	LPOINT PEN			
FACILITY NA	M€ Un	ocal Chemicals - Carteret, NJ		SW ID NO MW	-4
LAB NAME	N&	ANCO Laboratories - Wappingers Fa	lls NY		
•	0   2   6   0   7   2   10   10   10   10   10   10   10	WELL PERMIT NO. YR. [ :	D 2 0 7	7 7 4 A D	WCM USE
		SUBMIT WITH SIGNED T-VW	X-014		
SAMPL	ing months				š
	Auf V		UNITS	PARAMETER	VALUE
x x	x   x	Specific Conductance	umhos/cm		
X   X		Floating Product	inches		111110
x x			13		
		Total Xvlenes	ug/l		1 1 0 0
11111	<del>-                                      </del>				
1111	111111			++++	<u> </u>
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1111			<del></del>		

		1:11	1:1:
VALUE CODING RULES AND REMARK CODES ON REVERSE .	29	33 34	40 41
	42	46 47	33 34
	55	59 40	44 47
	68	72 73	79 80

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11111

Fem YWX-017 4/83 72

#### MEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT . DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID,	BASE/NEUTRAL	ORCANIC	COMPOUNDS
PLEASE TYPE OR PRINT WITH BALLPOINT PEN			

Unocal Chem	icals - Carteret, NJ		SW 10 NO. MW-4	
NANCO Labor	atories - Wappingers F	alls. NY		
NEDER NO.	WELL PERMIT NO.	TE. NO. IDAT	NU LAS CERT. NO.	MCM CEE
	NANCO Labor	.,	NANCO Laboratories - Wappingers Falls, NY  SANCE DATE .  WELL PERMIT NO. TR.   MO.   DAT	NANCO Laboratories - Wappingers Falls, NY  NAPPERNO. WELL PERMIT NO. TR.   MO.   DAT   NU LAB CERT. NO.

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 1018 1818 TO 18 19 19

#### SCIMIT WITH SIGNED T. TWI-014

SAMPLING MONTHS	acount Pitti Stote Division	<del></del>			P.K.
1111111111	AMALYES	UNITE	PARAMETER	ANTRE	PPHARKS
	Chrysene	ug/1	3 4 3 2 0		T
	Dibenzanthracene	ug/1	3 4 5 5 6		Τ
	1,2-Dichlorobenzene	ug/1	3 4 5 3 6		Γ
	1,3-Dichlorobenzene	ug/l	3 4 5 6 6		Γ
	1.4-Dichlorobenzene	ug/l	3 4 5 7 1		Γ
	3.3'-Dichlorobenzidine	ug/1	3 4 6 3 1		Γ
	Diethyl Phthalate	ug/1	3 4 3 3 6		Γ
	Dimethyl Phthalate	ug/1	3 4 3 4 1		Γ
	Di-n-butyl Phthalate	ug/1	3 9 1 1 0		
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1		
	2,6-Dinitrotolulene	ug/1	3 4 6 2 6 1		П
	Di-p-octyl Phthalate	ug/1	3 4 5 9 6	1 1 1 1 1	П
	1.2-Diphenylhydrazine	ug/1	3 4 3 4 6		П
	Fluoranthene	ug/1	34376		$\sqcap$
	Fluorene	ug/1	3 4 3 8 1		$\sqcap$
	Bexachlorobenzene	ug/1 -	39700		$\neg$
	Hexachlorobutadiene	ug/l	3 4 3 9 1	11111	$\exists$
	Bexachlorocyclopentadiene	ug/1	3 4 3 8 6	11111	7
	Rexachloroethane	ug/1	3 4 3 9 6 1	11111	$\neg$
	Indenopyrene	ug/1	344031		٦
	Isophorone	ug/1	34408		7
	Machchalene	ug/1	3 4 6 9 6		٦
	Mistabenzene	uz/1	34447		7
	H-Wistonendi-enclyating	uz/1	344381		٦
	N-Nicrosodi-n-propylsmine	ug/1	3 4 4 2 8	11111	7
	N-Nitrosodiphenylamine	ug/1	3 4 4 3 3 .1	11111	7
	Phenanthrene	· ug/1	3 4 4 6 1		1
	Pyrene	ug/l	3 4 4 6 9		
	1.2.4-Trichlorobenzene	ug/1	3 4 5 5 1 1		]
VALUE CODING RULES AN REMARK CODES ON REMER	0		29 23 24 42 44 47 64 50 60 64 72 73	40 4 61 5 64 6 79 60	4 7

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VALUE CODING RULES AND

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

WATER QUALITY MANAGEMENT ELEMENT

### GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

FACILITY N	LAME Unoc	NJ	SH 10 NO. MW-4					
LAS HALLS	- NANCO Labora	itories - Wappingers Fa	lls NY					
	NUPDES NO.	WELL PERMIT NO.	TR.   MO.   DAT	NI LAB CERT, NO,	MCM CEE			
向	N-0012601717	2 6 -0 8 5 5 5 5 -1	8 9 0 2 0 7	7 3 4 6 0	11			

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM | 018 | 818 TO | 18 | 19 |

SUBMIT WITH SIGHED T-YWX-014												
SAMPLING MONTHS	_	K 4										
ATTEMENT OF THE PROPERTY OF TH	TE PARAMETER	ANTRE 3										
		11111										
2,4-Dichlorophenol ug/l												
2,4-Dimethylphenol . ug/1		11111										
2,6-Dimitro-o-cresol ug/l		11111										
2,4-Dinitrophenol ug/1												
2-Nitrophenol ug/1		11111										
4-Mitrophenol ug/I												
p-Chloro-a-cresol ug/1		11111										
Pentachlorophenol ug/1	3 9 0 3 2											
	3 4 6 9 5											
	3 4 6 2 1											
Acenaphthylene ug/l												
Anthracene ug/1		1 1 1										
Benzidine ug/1		1 1 1 1										
Benzanthracene ug/1		1 1 1 1 1 1										
Benzopyrene ug/1	3 4 2 4 7											
3,4-Benzofluoranthene   ug/1	3 4 2 3 0											
Benzoperylene ug/1	3 4 5 2 1	11111										
Benzofluoranthene   ug/1	3 4 2 4 2	11111										
Bis(2-chloroethoxy)methane ug/1	3 4 2 7 8											
Bis(2-chloroethyl) Ether ug/l	3 4 2 7 3	1 1 1 1 1										
Bis(2-chlroisopropyl) Ether ug/1	3 4 2 8 3											
Bis(2-ethylhexyl) Phthalate ug/1	3 9 1 1 0 0											
4-Brozophenyl Ether ug/l	. 3 4 6 3 6											
Butylbentyl Phthalate ug/1	3 4 2 9 2	<u> </u>										
2-Chlarcaenhahalene Uz/l	13/4/5/01/	<u> </u>										
4-Chiorophenyl Phenyl Ether ' ug/l	3 4 6 4 1	1111111										

OPERATING EXCEPTIONS DETAILED			
	<del></del>		
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•			
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		•	
HOURS ATTENDED AT PLANT	Month L	Year	

Day of Month		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Licensed Operator								Π								
Others																
Day of Month		18	19	20	21	22	23	24	25	25	27	28	29	30	31	
Licensed Operator																
Others										Ī	1				ĺ	

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### W JERSEY DEPARTMENT OF THEMPRESE YERREL W. DIVISION OF WATER RESOURCES

#### WATER QUALITY MANAGEMENT ELEMENT

#### GRU ID WATER ANALYSIS - MONITORING WELL REPORT

A N	D b k b b	26-08557-7 819	DE DATE MO.   DAY D  2 10   7	NI LAB CERT. NO.  7 3 4 6 0  23 27	Wam use
A N	d d y q q	D. WELL PERMIT NO. YR. 1  7 7 26-08557-7 891  1. COW IS TO 35 085ERVED FROM 0 18 18 18 TO	MO.   DAY 0   2   0   7		WOM USE
1	dqqqq	77 26-08557-7 890	0 2 0 1 7		WOM USE
1	-	LOW IS TO BE OBSERVED FROM 0 18 18 18 TO		7 3 4 6 0	
THE SCHEDUL	E INDICATED SE	<b></b>	0:8 9:2	23 21	<u> </u>
THE SCHEDUL	e cetazioni e	<b></b>	0 8 9 2		
			MO. YE.		
		SURMIC WEIGH SIGNED TAYW	r.114		
	C 11016116	SUBMIT WITH SIGNED T-VW.			
	ZHTNOM D Z + i i i i	Ý ANALYSIS	ZTINU	PARAMETER	VALUE
	A S S S S	<del></del>	<del></del>		
$XI \mid XI \mid$	MIXI	Elevation of top of well casing with cap off	feet MSL: to nearest .01		8 6 0
MIMI	MIMI	Elevation of original ground level	feet MSL:		8.84
$\frac{1}{1}$	$\frac{1}{1}$	(as specified in well completion report)	to nearest .01		1   0   - 10   4
<u> </u>	XIIXII	Depth to water table from top of casing prior to sampling with cap off	feet: to nearest 01	8 2 5 4 6	4 40
MIMI	XIXI	Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	4.64
i i X		Arsenic, Dissolved	UG/L as As	011000	
11111		Barium, Dissolved	UG/L as 3a	0110015	
		Biochemical Oxygen Demand - 5 Day	MG/L	00310	
		Cadmium, Dissolved	UG/L as Cd	0 1 0 2 5	
XIXII	XIXI	Chlaride, Dissalved	UG/L as CI	8 2 2 9 5	3 5 8 1 0 0
1   1   1		Chromium, Dissolved	UG/L as Cr	0 1 0 3 0	
		Chromium, Dissolved, Hexavalent	rick ratics	0 1 2 2 0	
1111	1111	Chemical Oxygen Demand (COD), Dissolved	MG/L	0 0 3 4 1 1	1111
1111		Caliform Group	N/100 ML	7 4 0 5 6 1	
		Color	Pt - Ca	000080	
11111	_	Capper, Dissalved	UG/L as Cu	01040	
		Cyanide, Total	MG/L as CN	007201	
		Endrin, Total	UG/L	3 9 3 9 0 1	
1111	1111	Fluoride, Dissolved	MG/L as =	00950	1 1 1 1 1
1 1 1 1 1	1111	Grass Alama, Dissalved	Pc/L	0 1 5 0 3	1 1 1 1
1 1 1 1 1 1	1111	Gross Beta, Dissolved	Pc/L	03503	1 1 1 1
1 1 1 1 1 1	1 1 1 1	Hardness, Total as CaCO <sub>3</sub>	MG/L	0 0 9 0 0 1	<u> </u>
1 1 1 1 1		Iran, Dissalved		0 1 0 4 6	<u> </u>
<del>                                     </del>	<u> </u>	Lead, Oissolved	UG/L as 25	0 1 0 4 9 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
11111	1111	Lindane, Total  Manganese, Dissolved	UG/L UG/L	3 9 7 8 2	<u> </u>

7 1 8 9 0

UG/L

VALUE CODING RULES AND REMARK CODES ON REVERSE

Mercury, Dissolved

#### Page 2

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

PLEASE	TYPE OF	PRINT WITH	1326	POINTPEN
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FACILITY NAS	ue Unocal Chemi	SW 10 NO. MW-6			
LAB NAME		itories, Wappingers F	alls. NY		
	NIPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT, NO.	WOM USE
S	N-0 0 2 6 0 7 7	26-0181517-7	8 9 0 2 0 7	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO SE OBSERVED FROM 0 18 8 18 TO 0 18 91 2

#### SUBMIT WITH SIGNED T-VWX-014

ं चें						HONTHS 로 보고 보고 ANALYSIS UNITS										• • •							ALUE				
<u> </u>	3	₹	<u> </u>	<b>⊰</b> 	<del>-</del>	<u> </u>	<u>, 4</u>	ð	7	-	<del></del>	<del>,                                      </del>	_		_	_		ER		<del>-</del>	<u> </u>	/AL	,UE	<del>,     </del>	<del>.</del>		
Ļ			1	_	4			_	<u> </u>	1_	Methoxychlor, Total	UG/L	-+	<del></del>		<u> </u>	_	10	-	Ļ	┿	Ļ	Ļ	⊢	Ļ		
Ļ			_	4	_!	_		<u> </u>	Ļ	丰	Methylene Blue Active Substances	MG/L	-		_		_	10	_	Ļ	Ļ	Ļ	Ļ	<u> </u>	Ļ		
<u>L</u>				_					L		Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N		-	_	_		_	8 !		<u>_</u>	_	Ļ	<u> </u>	<u></u>	<u> </u>		
				_	1					<u> </u>	Nitragen, Nitrate Dissolved	MG/L as N	_	_	_	_	_	8		<u> </u>	$\perp$	<u> </u>	<u> </u>		<u> </u>		
			$\perp$		_]	_				<u> </u>	Odor	T.O.N.	-+		_	_	_	5	$\overline{}$	<u> </u>	<u> </u>	<u> </u>	<u> -</u>				
		X	1	1	_!	_					Нс	Standard Units	少	0	٥	4	0	10	L	$\perp$	1	6		3	6		
		1	1	1	1		1				Phenois, Total Recoverable	UG/L	_[:	3	2	7	3	10	$\perp$	!	1	_	!		!		
					I	•					Radium 225, Dissolved	Pc/L	止	<u> </u>	9	5	0	3	L		1	_			_		
				Ī	I						Radium 228, Dissolved	Pe/L	[	3	1	3	6	6			1			i	ĺ		
		T		T	T		-		_		Selenium, Dissolved	UG/L	I	اد	1	1	4	5	$oxed{L}$	Ţ				<u>i</u>			
		1	T	T	T	1	-	1		1	Silver, Dissalved	UG/L	To	ij	1	0	7	5	T	Ī	Ī		$\Box$	Ī	Γ		
	1	1		1	Ī	Ī	-	1			Sadium, Dissalved	MG/L	To	)	٥l	9	3	0	Γ	Π	Ī	Γ	$\sqcap$	$\exists$			
Ī	1	X	1	Ī	T		]				Sulface, Dissolved (as SO <sub>4</sub> )	MG/L	To	ار	σi	9	4	5	Γ			i		Ī			
Ī	1	X	Ī		(	Ī		X1			Total Oissolved Solids (TOS)	PPM	77	111	٥Ī	3 !	0	a	П	Ī	Ţ		8	8	9		
Ť	ĺ	Ì	1	1	Ť	Ť	ĺ	7			Total Organic Carbon (TOC)	PPM	To	1	σĪ	s ;	3	0						$\overline{}$	_		
i	Ť	Ť	Ť	Ť	Ť	Ť	Ť	Ť	_		Total Organic Halogen (TOX)	UG/L	-	_	_	3 !	_	_			$\overline{}$	$\overline{}$	ī	T	_		
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### NO:TDETOPS THEMNORIVE OF THEITRESS YESREL WEN CONTRIBUTED RESURES

#### WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYPE	e or print with ballpoin	vt Pen			
FACILITY NA	unocalChemic	al _ Carteret, NJ		5W 10 NO MW-6	
LAB NAME	NANCO Labor	atories- Wappinger Fal	ls. NY		·
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	IJ LAB CERT, NO.	WCM USE
T	K K P P R P P P	2 6 0 8 5 5 7 7	8 9 0 2 0 7	रा अ व व व	

THE SCHEDULE INDICATED SELOW IS TO SE DESERVED FROM 0. 17. TO 0 18 9 12 1

#### SURMIT WITH SIGNED T-VWX-014

	SUBMIT WITH SIGNED	1-NMX-017		s,
Sampling months				× ×
Jan. Mar. Mar. Mary June Aug. Sept. Nov.	ANALYSIS	UNITS	PARAMETER	AYFAE AF
MINIMIM	Acrylanivile	UG/L	3 4 2 1 1 5	2 5 K
	Bentene	UG/L	3 4 10 13 10	
	Bromoform	UG/L	3 2 1 1 0 4	
	Carbon Tetrachtoride	UG/L	3 2 1 0 2	1 0!0 K
	Chigropenzene	UG/L	3 4 3 0 1	1
	Chlorodibromoethane	UG/L	3 4 3 0:6	1 0 0 K
	Chloroform	UG/L	3 2 1 1 0 1 6	1   0   0   K
	1, 1 - Dichroroethane	UG/L	3 4 4 19 6	1 0;0 K
	1, 2 - Dichtoroethane	UG/L	31415 311	1 1 1 1 0 0 K
	1, 1 - Dichlaroethylene	UG/L	314 5 0!1	
11 1 11 1 11 1 11 1	1, 2 · Dichlorograpane	UG/L	3 4 5 4 1	1 0 0 K
	Ethylbenzene	UG/L	314 317 1	
	Methylene Chloride	UG/L	3 4 4 2 2 3	1  1  0  0
	1, 1, 2, 2 - Tetrachloroethane	UG/L_	3 4 5 1 1 - 5	1 1 1 1 1 1 0 1 0 K
	Tetrachidroethylene	UG/L	3 4 4 7 5	1100 K
	Taluene	UG/L	3 4 0 1 2	1 0 0 K
11 ! :1: 1 ! ! ! ! ! ! !	1, 1, 1 - Trichtoroethane	UG/L	3 4 5 0 5	:   3 2 0 0
	1, 1, 2 - Trichloroethane	UG/L	3 4 5 1 1 1	1 1 0 0 K
11   11   1   1   1   1   1	Trichloroethylene	UG/L	3 9 1 8 0	1 1 1 0 0 K
1 1 1 1 1 1 1 1 1 1 1 1 1 1	Vinyl Chloride	UG/L	3:911'7 5	1 1 0:0 K
11 1 11 1 1 1 1 1 1 1 1	Acrolein	UGIL	3141211-0	1   2:5 K
11 1 1 1 1 1 1 1 1 1 1	Chloroethane	UGIL	314 3: 111	1:00K
11 1 111 1 111 1 111 1	2 - Chigroemylvinyi Emer	UG/L	3 4 5 7 5	1 0 0 K
	Dichloropromomethane	UG/L	3 2 1:0:5	1 1 1 1 0 0 K
11 1 11 1 1 1 1 1 1 1	1, 3 - Dichtorograpytene	UG/L	3 4 6 9 9	11010 K
	Methyl Bramide	UG/L	3 4 4 1 1 1 3	!! 11 0 0 K
	Methyl Chloride	UG/L	3 4 4 1 1 8	1 0.0 K
11 1 11: 1 11: 1	1, 2 - trans - Dichtgroethylene	UG/L	314:5:4.5	110;0 K
	1, 2 Dichtgrabenzene	UG/L	314151315	!   1 0 0 K
	1, 3 Oichiarabenzene	UG/L	314 5:5.5	! '   1  0·0   K
11 1 1 1 1 1 1 1 1 1 1 1	1, 4 Dichtaracenzene	UG/L	3 4 5 7 1	12:5:0:0:0 C
VALUE COOING RULES AND			29 13 14 42 46 47 13 39 40 64 72 73	40 +: 51 54 53 57 79 40

VALUE CODING RULES AND REMARK CODES ON REVERSE Form 941X-017 UZI

P1

VALUE CLOING RULES AND

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID. BASE/HEUTRAL ORGANIC COMPOUNDS

PLEASE TY	PE OR PRI	NT MITH BALLPOIN	TPEN		SH 10 NO.		-
FACILITY !			il Chemical - Carteret,	NJ	MW-6		
LAB HAME	• •	NANCO Labora	tories - Wanningers Ea	lls NY			
ा	-	MUPDES NO.	WELL PERMIT NO. 2 6 -0 8 5 5 7 -7	EAMPLE DATE TE.   MO.   DAY  8 9 02 0 7	NI LAB CERT. NO.	MCM CZE	

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 18 18 18 TO 1018 913

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111111	1111	AKALYES	UNITE	PARAMETER	VALUE											
	TXIT	2-Chlorophenol	ug/1	3 4 5 8 6												
		2,4-Dichlorophenol	ug/1	3 4 6 0 1												
▎ <del>▊▗▍</del> ▗▎ <del>▗</del> ┆		2,4-Dimethylphenol .	ug/1	34606												
	1111	2,6-Dimitro-o-cresol	ug/1	77603	<del>! !   !   !   .</del>											
		2,4-Dinitrophenol	ug/1	3 4 6 1 6	<del>!                                    </del>											
		2-Nitrophenol	ug/1	3 4 5 9 1	<del>                                     </del>											
. <del>                                    </del>		4-Nitrophenol	ug/I···	3 4 6 4 9												
	1111	p-Chloro-a-cresol	ug/l	3 4 4 5 2	<u> </u>											
		Pentachlorophenol '	ug/1	39032	<u> </u>											
. <del>                                    </del>	1111	Phenol	ug/1	3 4 6 9 5	1 1 1 1 1 1											
<del>                                   </del>	11:11	2.4.6-Trichlorophenol	ug/l	3 4 6 2 1	<u>                                     </u>											
· <del>                                    </del>	1111			1 1 1 1 1	1 1 1 1 1 1											
1 <del>                                    </del>		Aconshibene	uz/1	13/6/2/0/5												
		Acenaphthylene	ug/l	3 4 2 0 0	11111											
		Anthracene	ug/l	3 4 2 2 0	1 1 1 1 1 1											
		Benzidine	ug/1	3 9 1 2 0	<u> </u>											
	1111	Benzanthracene	uz/1	3 4 5 2 6												
. <del>                                    </del>	11:11	Benzopyrene	ug/l	3 4 2 4 7	1 1 1 1 1											
	1111	3,4-Benzofluoranthene	ug/1	3 4 2 3 0												
	1111	Benzoperylene	uz/1	3 4 5 2 1												
ı <del>┠┢┢┢</del> ┪	1111	Benzofluoranthene	ug/1	3 4 2 4 2												
Ĭ <del>ĔŦŦĬĬĬ</del>		Bis(2-chloroethoxy)methane	ug/1	3 4 2 7 8												
	<del>-                                      </del>	Bis(2-chloroethyl) Ether	ug/l	3 4 2 7 3												
		Bis(2-chiroisopropyl) Ether	ug/l	3 4 2 8 3												
╹ <del>┠╶╏</del> ╴╏		Bis(2-ethylhexyl) Phthalate	ug/1	3 9 1 0 0												
╻ <del>┠╶┆╶┆╶┆╶┆</del>	<del>-                                      </del>	4-Bromophenyl Ether	ug/l.	3 4 6 3 6	<u> </u>											
┃ <del>┃ ┆ ┆ ┆ ┆ ┆ ┆</del>	++++	Burylbenzyl Phthalate	_ug/l	3 4 2 9 2	<u> </u>											
		2-Chlorenenhahelene	uz/1	3/4/5/2/1	<del></del>											
	1111	4-Chlorophenyl Phenyl Ether	ug/l	346411	40 41											

Ferm YWX-017 4/E3 P2

# HEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT : ESPANCES RESTAW TO MOISIVID THEMESE THEMESEANAM YTIJAUD RETAW

### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

LEASE TYPE	OR PRINT WITH BALLPOI	NT PEN

FACILITY NAME	Unocal Chem	icals - Carteret, NJ		SW 10 40.	
LAC SME	NANCO Labor	atories - Wappingers	Falls, NY		
סרא נו	n b k h b b	2 6 -0 8 5 5 7 -7	\$200 LE DATE . TR.   MO.   DAT	NU LAS CERT, NO.	#CH LEE

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 0181818 TO 0181912

#### SUBMIT WITH SIGNED T-FWX-014

STROM DISTRIB			•	# # # # # # # # # # # # # # # # # # #
111111111111	AMALYTE	UNITS	PARAMETER	AVTRE \$
	Chrysene	ug/l	34320	
	Dibenzanthracene	ug/1	3 4 5 5 6	
	1,2-Dichlorobenzene	ug/1	3 4 5 3 6	
	1.3-Dichlorobenzene	ug/1	3 4 5 6 6	
	1,4-Dichlorobenzene	ug/1	3 4 5 7 1	
	3,3'-Dichlorobenzidine	ug/l	3 4 6 3 1	
	Diethyl Phthalate	ug/1	3 4 3 3 6	
	Dimethyl Phthalate	ug/l	3 4 3 4 1	
	Di-n-butyl Phthalate	ug/l	391110	
	2,4-Dinitrotolulene	ug/l	3 4 6 1 1	
	2,6-Dinitrotolulene	ug/l	3 4 6 2 6	
	Di-m-octyl Phthalata	ug/1	3 4 5 9 6	
	1,2-Diphenylhydrazine	ug/1	3 4 3 4 6	
	Fluoranthene	ug/1	3 4 3 7 6 1	
	Fluorene	ug/1	3 4 3 8 1	
	Hexachlorobenzene	ug/1 -	39700	
	Hexachlorobutadiene	ug/1	3 4 3 9 1	
	Bexachlorocyclopentadiene	ug/1	3 4 3 8 6	
	Hexachloroethane	ug/1	3 4 3 9 6 1	
	Indenopyrene	ug/1	344031	
	Isophorone	ug/1	34408	
	Waphthalene '	ur/1	346961	
	Mizzabenzene	uz/1	344471	
	H-Wittngodinentlyanine	uz/1	344391	
	N-Mitrosodi-n-propylamine	ug/l	344281	
	N-Mitrosodiphenylamine	ug/l	3 4 4 3 3 . 1	
	Phenanthrene	· uz/1	3 4 4 6 1	11111
	Pyrene	ug/1	3446911	
	1.2.4-Trichlorobenzene		3 4 5 5 1 1 1	

VALUE CODING RULES AND REMARK CODES ON REVERSE

# NEW JEASEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

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VALUE COOING RULES AND	29 42	33 3-	40 41 33 34

42 55 64 46 47 59 40 72 73 13 14 44 47 77 10 REMARK CODES ON REVERSE

### MITDETORY JETHEMMORIVE TO THEMTRESO PEREL W. CEDUROSE RESOURCES

WATER QUALITY MANAGEMENT ELEMENT

#### GRU ID WATER ANALYSIS - MONITORING WELL REPORT

FACILITY NAME Unocal Cheminal Carteret, N.1		SW 10 NO MW-7	
NANCO Laboratories, Wappingers Falls, NY			
	LE DATE		
	MO.   DAY	NJ LAB CERT. NO.	WOM USE
1618 5-18151810-912 KKDPKPPN H	0 2 0 7	7 3 4 6 0	
		•-	
THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 1018 818 TO	0 18 9 12		
SUBMIT WITH SIGNED T-VWX	raia		
			<u>د</u> د
SAMPLING MONTHS  E = : : : : : : : : : : : : : : : : : :	UNITS	PARAMETER	VALUE
THE WAY A CONC.		1	
Elevation of top of well casing with cap off (as specified in well completion report)	feet MSL: to nearest .01		8 . 2 4
M   M   Elevation of original ground level	feet MSL:		
(as specified in well completion report)	to nearest .01	<del>                                     </del>	8 . 8 3
Depth to water table from top of casing prior to sampling with eap off	feet: to nearest 01	8 2 5 4 6	4.74
Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	5.33
Arsenic, Dissolved	UG/L as As	01101010	
	UG/L as Ba	0 1 0 0 5	
Biochemical Oxygen Demand - 5 Day	MG/L	003110	
Cadmium, Dissalved	UG/L as Cd	0 1 0 2 5	
X    X    X     Chlorice, Dissolved	UG/L as CI	8 2 2 9 5	121910191010
Chromium, Dissolved	UG/L as Cr	0 1 0 3 0	11111
Chromium, Dissolved, Hexavalent	riè\r as Ct	0 1 2 2 0	
Chemical Oxygen Demand (COO), Oissolved	MG/L	0 0 3 4 1	
Cotiform Group	N/100 ML	7 4 0 5 6	
	Pt - Ca	000080	
Capper, Dissalved	UG/L as Cu	01040	
Cyanide, Total	MG/L as CN	0 0 7 2 0	
Endrin, Total	UG/L	3 9 3 9 0	
Fluaride, Dissalved	MG/L as =	00950	1 1 1 1 1
Gross Alona, Dissolved	Pc/L	011503	
Gross Beta, Dimolved	Pc/L	0 3 5 0 3	
Hardness, Total as CaCO <sub>3</sub>	MG/L	001810101	
	UG/L as Fe	0 1 0 4 6	
1   X     Lead, Dissolved		0 1 0 4 9 1	
Lindane, Total	UG/L	3 9 7 8 2	1 1 1 1 1
	UG/L	0 1 0 5 6	
Mercury, Dissolved	UG/L	7 1 1 8 9 0 1	1 1 1 1 1

VALUE CODING RULES AND REMARK CODES ON REVERSE

### THEMELE THEMEDANA THIS RETAW

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT WITH 9AL I POINT PEN

FACILITY NAN	unocal Chemi	cals - Carteret, NJ		SW 10 NG.	
SMAN BA		atories, Wappingers F	alls. NY	<u></u>	
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR. 1 MO. 1 DAY	NJ LAB CERT, NO.	WOM USE
S	N-0 0 12 16 10 17 17	26-08558-5	890207	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO SE OBSERVED FROM DE BEN TO 18 912

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1	1	1	<u>                                     </u>		1						Methylene Blue Active Substances	MG/L	1	<u> </u>	8	2	6	0					1	1	I
	$\perp$		<u>    </u>				1				Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	1	0	0	6	0	8						1	
1											Nitragen, Nitrate Dissolved	MG/L as N	止	o	0	6	1	8					-	İ	I
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	1	1		1			$\Box$				Phenois, Total Recoverable	UG/L	$\exists$ :	3	2	7	3 1	g.	$\square$ !	T	1	!	!	!	Ī
	L				T	ļ					Radium 225, Dissolved	PerL	T	3   c	9	5	0	3	П	ī	T	T	T	Ī	Ī
1	Ī		1	Ī	T		1	Ī	Ī		Radium 229, Oissolved	Pe/L	1	3	1	3	6	6	Π	T	T	T	1	i	Ī
T	T		T			Ī	Ī	Ī	I		Selenium, Dissalved	UG/L	To	<b>3</b>	1	1	4	5	Π	T	T	1	T	1	Ī
T	Π	$\prod$		T		Ī	T	Ī	Ī	1	Silver, Dissalved	UG/L	To	ij	1	0	7	5	Ţ	T	T	T	Τ	i	Ī
T	Π	1 1	Ī	T	1	Ī	T	Ī	Ī	T	Sadium, Dissalved	MG/L	0	1	)	9 :	3 !	٥	Ī	$\top$	T	T	Τ	1	İ
1		IX.	1	1	- <u>-</u>	Ī	Ţ	Ī	T	T	Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	To	110	i	9	4 ;	6	T	1	1	Τ			Ī
4	1	X	1		<u> </u>	1	I)	1	1	T	Tatal Dissalved Salids (TDS)	PPM	7	ic	)	3	a :	0	ī	Ţ	T	19	13	19	Ī
			T	T	Ī	Ī	T	Ī	Ī	T	Total Organic Carbon (TOC)	PPM	0	0	1	5	8 ;	0	T	T	T	Ī	Π	Π	ĺ
	Ī			T	Ī	Ī		Ī	1	1	Total Organic Halogen (TOX)	UG/L	7	10	1	3	5 ;	3	Ť	T	Ť	ī	Ī		ĺ
11	<u> </u>		T	1	T	1	1	1	Ī	T	Toxagnene	UG/L	13	ļg	1	4 ! (	o   c	٥	Ť	Ť	Ť	Ī		i	_
		Π	I	T	Ī	Τ	1	Ī	Ī	T	Turbidity	NTU	0	lo	1	<u>,                                    </u>	7   (	5	Ī	T	1	Ī			_
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ii		i	<del>i</del>	<del>i</del>	<del>:</del>	<del>i</del>	i	<del>i</del>	<del>†</del>	$\dagger$			H		<del>:</del>	Ť	<del>i</del>	$\dagger$	1	$\frac{\cdot}{1}$	i	<u> </u>	:	i	-
ii	-	i	Ť	i	<del>'</del>	i	<del>i</del>	<u> </u>	<del>i</del>	t			H	<u> </u>	i	<u>.</u>	$\frac{\cdot}{1}$	$\dagger$	÷		<u> </u>	<u>;</u>	ij	寸	-
VAL REM										 =			29 42 55		<u>'</u>		39	3 3 6 4 9 4	7	<u>· · ·</u>	<u>'</u>			93 5 53 5 54 6 73 6	141

### NOTESTANDANDANDANDA THENT OF ENVIRONMENTAL PROTECTION OF WATER RESOURCES

#### WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

FACILITY NAME	UnocalChemica	al _ Carteret, NJ		SW 10 NO. MW-7	
LAB NAMÉ	NANCO Labora	tories- Wappinger Fal	ls. NY		
	nipoes no.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LAB CERT, NO.	WOM USE
LN T	d d z d d z z	26-085585	8 9 9 9 9 9 9 9	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 10 8 8 8 TO 0 10 12 1

#### SUBMIT WITH SIGNED T.VWX-014

	SUBMIT WITH SIGNED T.V.	7.(-014		S
sampling months				â Y
Feb. Ker. Apr. Ans. Aug. Sept. Oct.	MALYSIS	TINU	PARAMETER	AYCAE C
MINIMIMI	Acrylonitrile	UG/L	3 4 2 1 5	1 1 1 5 0 0 K
	Bentene	UG/L	3 4 10 13 10	1   1   2   0   0
	Bromoform	UG/L	3 2 1 10 4	2 0 0 K
	Carbon Tetrachtoride	UG/L	3 2 1 1 0 2	2 0!0 K
	Chloropenzene	UG/L	3 4 3 0 1	
	Chlorodibromoethane	UG/L	3 4 3 0:6	2 0 0 K
	Chloroform	UG/L	3 2 1 1 0 6	2 0 0 K
	1, 1 - Dicatoroethane	UG/L	3 4 4 9 6	4 8 0:0
	1, 2 - Dichloroethane	UGAL	3 4 5 3 1	1 113:0100
	1, 1 - Dichlorgethylene	UG/L	314 5 0 1	1 1219 1010 0
	1, 2 - Dichloropropane	UG/L	3 4 5 4 1 1	2 0 0 K
	Ethylbenzene	UG/L	3 4 3 7 1	2 0 0 K
	Methylene Chloride	UG/L	3 4 4 2 3	
	1, 1, 2, 2 - Tetrachloroethane	UG/L	3 4 5 1 5	2 0 0 K
	Tetrachloroethylene	UG/L	3 4 4 7:5	2 0 0 K
	Taluene	UG/L	3 4 0 1 2	4 5 0 0
	1, 1, 1 - Trichlorgethane	UG/L	3 4 5 : 0 : 6	2 7 1 1 10 0 0 C
	1, 1, 2 · Trichloroethane	UG/L	3 4 5 1 1 1	2 0 0 K
11 1 111 1 111 1 111 1	Trichloroethylene	UG/L	3 9 1 8:0	2 0 0 K
	Vinyl Chloride	UG/L	3 9 1 1 7 5 1	!   2 0 0 K
	Acrolein	UGIL	3 4 2'1.0	1 -5 0:0
	Chloroethane	UG/L	314 3:111	2i 0! 0 K
11 1 111 1 111 1	2 - Chloroemylvinyl Emer	UGIL	3 4 5 7 6 1	i     2 0 0 K
11 1 11   1   1   1   1   1	Dichloropromomethane	UG/L	3 2 1 1 0 : 5 1	1 1 2 0 0 K
11 1 111 1 111 1 111 1	1, 3 - Dichtoropropytene	UG/L	314 61919	2  0  0 K
11 1 11: 1 11: 1 11: 1	Metnyl Bromide	UG/L	3 4 4 1 1 1 3 1	!! 2000 K
	Metnyi Chigride	UG/L	3 4 4 1 8 1	1 1 2 0 0 K
11 1 11: 1 11: 1	1, 2 - trans - Dichtgroethylene	UG/L	3 4 5 4 5 1	2 0;0 K
11 1 111 1 111 1 111 1	1, 2 Dichtarabenzene	UG/L	314151315 !	! 1 2 0 0 K
11 1 1:1 1 1 1 1 1 1 1	1, 3 Oichtarapenzene	UG/L	314 5:5:5	! !   2 0 0 K
	1, 4 Oichtaradentene	UG/L	314 5 7'1  1	2  0:0  K
VALUE COOING RULES AND		<del></del>	29 13 14 47 46 47 55 39 40 68 72 73	40 · 1 31 34 54 57 73 40

VALUE COOING RULES AND REMARK CODES ON REVERSE Ferm YMX-017 6/83

P1

VALUE CODING RULES AND

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

#### WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID. BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TY	PE OR PRINT WITH BALLPOIN	TPEN		15W 10 NO.	
FACILITY	Lane 3	1 Chesical - Carteret	, NJ	MW7	
LAS NAME	· NANCO Labora	tories - Wappingers Ea	alls NY		
Ď	NUPDES NO. NU 0 0 2 6 0 7 7	26-08558-5	TR.   MO.   DAT	73460	MCM (ZE

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 10 18 18 TO 1018 912

	•		SUBMIT WITH SIGNED T-FW	T-014	•	_
2	THE PHE	ovmet	•			
113	} } } }	1111	AMALYES	UNITS	PARAMETER	VALUE
		<u>TXT</u>	2-Chlorophenol	ug/1	3 4 5 8 6	
1117			2.4-Dichlorophenol	ug/l	3 4 6 0 1	
	111		2,4-Dimethylphenol .	ug/1	34606	
			2,6-Dinitro-o-cresol	ug/1 ·	77603	11111
			2,4-Dinitrophenol	ug/1	346116	<u> </u>
			2-Nitrophenol	ug/1	3 4 5 9 1	<del>                                     </del>
			4-Nitrophesol	ug/I··	3 4 6 4 9	<u> </u>
			p-Chloro-a-cresol	ug/l	3 4 4 5 2	<u> </u>
		-	Pentachlorophenol '	ug/1	3 9 0 3 2	
	111		Phenol	ug/1	3 4 6 9 5	
	111		2.4.6-Trichlorophenol	ug/1	346211	1 1 1 1 1 1
	111				1   1   1	11111
			Aranahahana	42/1	13/6/2/0/5	
			Acenaphshylene	ug/l	34200	<u> </u>
	<del>                                      </del>		Anthracene	ug/l	3 4 2 2 0	1 1 1 1 1 1
1			Benzidine	ug/1	3 9 1 2 0	11111
<del>         </del>	<del>-          </del>		Benzanthracene	ug/1	3 4 5 2 6	11111
<del>}                                    </del>	<del>-      </del>		Benzopyrene	ug/1	3 4 2 4 7	
<del>                                     </del>	+ + + +		3.4-Benzofluoranthene	ug/1	3   4   2   3   0	
<del>}                                    </del>	+ + + +		Benzoperylene	ug/l	3 4 5 2 1	
	+ + + +		Benzofluoranthena	ug/1	3 4 2 4 2	
	+ + + + +		Bis(2-chloroethoxy)methane	ug/l	3 4 2 7 8	
	+ + + +		Bis(2-chloroethyl) Ether	ug/l	3 4 2 7 3	
<del>                                      </del>			Bis(2-chlroisopropyl) Ether	ug/l	3 4 2 8 3	
	<del>-                                    </del>		Bis(2-ethylhexyl) Phthalate	ug/1	3 9 1 0 0	
	+ + + +	<del>-                                    </del>	4-Bromophenyl Ether	ug/1.	3 4 6 3 6	
<del></del>	+ + + +	<del></del>	Butylbenzyl Phthalate	ug/1	3 4 2 9 2	
<del></del>	+ + + +		2-Chloropenhalene	u2/1	3/4/5/0/1	
┠┼┼┼	╂╁╁╏	<del>-                                    </del>	/ Chloropheryl Phenyl Fiher	ug/1	3 4 6 4 1 1	

29 42 64

Fem YMX-017 4/E3 72

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#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

•	FACE	TYPE	000	RINT	MITH	BAL	LPOINT.	DEN	
	E 736	1 , , ,	<b>-</b>		** * * ~			r 5 /4	

FACILITY NAME	Unocal Cher	icals - Carteret, NJ		SW 10 NO. MW-7	
LAC SHE	NANCO Labor	atories - Wanningers	Falls, NY		
•	NJOES NO.	WELL PERMIT NO.	BANGLE DATE . TR.   MO.   DAT	NU LAB CERT, NO.	WCM USE

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM [0181818] TO [0181912]

26-08558-5

#### SCRNIT WITH SIGNED T-TWX-014

SAMPLING MONTHS								
1111111111	AMALTES	UNITE	PARAMETER	AVTAT AND AVERAGE				
	Chrysene	ug/l	34320					
	Dibenzanthracene	ug/l	3 4 5 5 6					
	1,2-Dichlorobenzene	ug/1	3 4 5 3 6					
	1,3-Dichlorobenzene	ug/1	3 4 5 6 6 1	11-11				
	1.4-Dichlorobenzene	ug/l	3 4 5 7 1					
	3.3'-Dichlorobenzidine	ug/1	3 4 6 3 1					
	Diethyl Phthalate	ug/1	3 4 3 3 6					
	Dimethyl Phthalate	ug/1	34341	1 1 1 1 1				
	Di-n-butyl Phthalate	ug/1	39110					
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1	1111				
	2,6-Dinitrotolulene	ug/1	3 4 6 2 6					
	Di-m-octyl Phthalate	ug/1	3 4 5 9 6					
	1,2-Diphenylhydrazine	ug/1	3 4 3 4 6 1					
	Fluoranthene	ug/1	3 4 3 7 6 1					
	Fluorene	ug/1	34381					
	Hexachlorobenzene	ug/1 ·	3 9 7 0 0 1					
	Hexachlorobutadiene	ug/l	3 4 3 9 1					
	Bexachlorocyclopentadiene	ug/l	3 4 3 8 6					
	Rexachloroethane	ug/1	3 4 3 9 6 1					
	Indenopyrene	ug/1	344031					
	Isophorone	ug/1	344081					
	Naphthalene	ur/1	34696					
	Microbensene	uz/1	344471					
	H-Wissandinesslyanine	uz/1	34439					
	N-Nitrosodi-n-probylatine	ug/1	3 4 4 2 8 1					
	N-Mitrosodiphenylamine	ug/l	34433.					
	Phenanthrene	· ug/l	344611					
	Pyrene	ug/l	344691					
	1,2,4-Trichlorobenzene	ug/l	3 4 5 5 1 1					

VALUE CODING RULES AND REMARK CODES ON REVERSE

#### NOITEET OPS LETANGANORIVAE AO TAIGNT HASSO TECHE, MEN SEDRUOZER RET AO NOIZIVIO TAIMELE TAIMEDANAM YTIJAUD RETAW

### GROUND WATER ANALYSIS - MONITORING WELL REPORT

P٤	51.	SE	TYP	E QA	PRINT	WITH	BALL	POINT	SEN
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FACILITY NA	ME Unocal	Chemicals - Carteret		SW 10 NO MW-7	<del></del>
LAB NAME		Laboratories - Wapping			
Ĺ	NJPOES NO. NJQ 0 2 6 0 7 7	WELL PERMIT NO. 216-08558-5	SAMPLE DATE YR.   HO.   DAY 8 9 0 2 0 7	MJ LAB CERT. NO.	WCM USE

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0. 88 8 TO 018 912 MO. YR.

#### SUBMIT WITH SIGNED T- VWX-014

	SUBMIT WITH SIGNED T-V	TV.Y-014		
Sampling months		<del></del>		n K
Jan. Fab. May. Juny Aug. Sapr. Dec.	ANALYSIS	UNITS	PARAMETER	AALUE 3E MA MA MA MA MA MA MA MA MA MA MA MA MA
x x x x	Specific Conductance	umhos/cm		1 1 3 3 1
				111111
$ \mathbf{x}   \mathbf{x}   \mathbf{x}   \mathbf{x} $	Floating Product	inches		111110
		_		
x   x   x   x	Total Xvlenes	ug/l		
		-		
			1111	
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		1		
VALUE CODING RULES AND REMARK CODES ON REVERSE	•	29 42 33 64	46 4 59 4	7 33 34 0 44 57

### MONITORING REPORT - TRANSMITTAL SHEET

NIPOES NO.

AEPORTING PERIOD .

80. TE

0:0:2:6:0:7:7

111818 THE 011819

PERMITTEE:	Unocal Chemical			
remail rec.	Address 1345 North Meachan	n Road		
	Schaumburg, IL	60196		
FACILITY:	Name <u>Unocal Chemicals C</u>	Division		
	Address350 Roosevelt Aven	we		
	Carteret	(County) Middlesex		
	Telephone ( 201 ) 541- 4224			
FORMS ATTACH	IED (Indicate Quantity of Each)	OPERATING EXCEPTIONS		
SLUDGE REPORTS	<del></del>	3.22.110.13	YES	NO
T-VWX-007	T-VWX-008 T-VWX-009	DYETESTONG		$\nabla$
SLUDGE REPORTS	·INOUSTRIAL	DNIZZATYB YRAPICHIGT		
T-VWX-010	BOLO-XMA-L	DISINFECTION INTERRUPTION		$\nabla$
		MONTORES MALFUNCTIONS		
WASTEWATER REP		UNITE CUT OF OPERATION		
T-VWX-011	T-VWX-012T-VWX-013	ОТНЕЯ		$\mathbf{X}$
GROUNOWATER RE	EPORTS .B) 1 VWX-016 1 VWX-017	(Dettil say "Yes" on reverse side in appropriate space.)		
NPDES DISCHARGE	MONITORING REPORT	NOTE: The "Hows Attended at Plan  Neverse of this sheet must also be com		ie
AUTHENTICATIO	information submitted in this of those individuals immediated submitted information is true, it	hat I have personally examined and am far focument and all attachments and that, bas y responsible for obtaining the information accurate and complete. I am aware that the formation including the possibility of fine	sed on n, I bei ere are	my inquieve the signific
LICENSED OPERA	TOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE		
Name (Printed)		Name (Prices) Daryl W. Dierwechte Supervisor Environm	ental	<del></del>
Grade & Registry No	o	Title (Primer) Affairs	<del></del>	
Signature		Signature X 22 A Live	r/ti	·
Date		March 21, 1989		

	NG EXCEPTIONS DETAILE	<u> </u>					
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	•						•
							Month Year L
IOURS A IT	ENDED AT PLANT						MONTH LL Tear LL
	Day of Month	11	2	3	4	5	6 7 8 9 10 11 12 13 14 15 16
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İ	Licensed Operator	1	] .	) j		1	

Day of Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Licensed Operator																
Others																
Day of Month	17	18	19	20	21	22	23	24	25	25	27	28	29	30	31	
Licensed Operator																
Others										· · ·						

•

Form VWX-015 A 4/83

## NOITSETORS JETNEMODRIVES TO THAMPAGE VESTEL W. ZEDRUCZER RETAW TO MOIZIVIO

#### WATER QUALITY MANAGEMENT ELEMENT

#### GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT	AE HTIW T	LLPOINT ! EN												
FACILITY NAME	nocal	Cheminal Carteret, N.1		2:4	10 /	<b>40</b> .	MW							
LAB NAME		atories, Wappingers Falls, NY												_
		PMES	LEDATE							Ī		=	=	ī
	NJPOES NO		MO.   DAY	_	_		RT. /	<b>→</b>			WQ	, wi	) JSE	1
ही भगेंपर	d a d d	77 26-018151519-3 81910	12 10 17	7	3	4	<u>6 lo</u>					Ų	l	
		10001								•				_
THE SCHEDULE INDI	ICATED BE	LOW IS TO BE OBSERVED FROM 0 8 18 1 TO	MO. YR.											
		SUBMIT WITH SIGNED T-VWX	-014											
Sampling Mon	arrie .													
Apr. Apr. Apr. Apr. Apr. Apr. Apr. Apr.		Ý ANALYSIS	UNITS	P	ARA	ME	TER			VA	LUE	į		
4 4 2 2 2 3 3 3 3 4 4 4 4 4 4 4 4 4 4 4	J A A I	<del></del>	<del></del>	_				_	<del></del> i	_		· 	<del></del>	7
$X \mid X \mid X \mid X$		Elevation of top of well casing with cap off (as specified in well completion report)	feet MSL: to nearest .01								Q	1,	R 2	
MIMIM	ÌМі	Elevation of original ground level	feet MSL:	$\top$				T		1		$\top$	T	Ţ
MININ		(as specified in well completion report)	to nearest .01	+	<u> </u>		1	+	$\vdash \vdash$		9 .	- 4	4 3	1
MIXIX		Depth to water table from top of casing prior to sampling with cap off	feet: to nearest .01	8	2	5 /	6		$  \  $		4.	. 5	0	
MIMIXI	IMI	Depth to water table from original ground level	feet: to	7	2	0	1 9	Π	$\prod$	T	5 .	1	Ī.	Τ
M I WI I VI		prior to sampling	nearest .01 UG/L as As	1			0 0	┼	<del>   </del>	+	<u>귀·</u>	<del>!!</del>	₩	╀
	1 1 1	Arsenic, Dissalved	<del> </del>	_			)   5	+	<del>   </del>	+	⊹	十	十	ł
	<u> </u>	Barium, Dissolved	UG/L as 3a	-	÷		0	╀	<del>-                                    </del>	+	+	⊹	<del>!</del> _	╀
	<u> </u>	Biochemical Oxygen Demand - 5 Day	MG/L	+	<del>-</del>	<del>-</del>	<del></del> -			÷	+	÷	╀	╀
		Cadmium, Dissolved	UG/L as Cd	-	1 0	÷	<del></del>		1	0 12	4	<u> </u>	<del> </del>	╀
	<del>       </del>	Chloriae, Dissalved	UG/L as CI	+ -	2   2		÷	Н		<u> </u>	14	+	-	╀
	1 1 1	Chromium, Dissolved	UG/L as Cr	+ +	1 0	<del></del> -		H	<del>-</del>	+	╀	<del>                                     </del>	$\vdash$	⊣
		Chromium, Dissolved, Hexavalent	UG/L as Cr	+	1   3		<del></del>		<del>+</del>	+	┿	-	$\sqcup$	-
		Chemical Oxygen Demand (COD), Dissolved	MG/L	<del>- :</del>	0   3	÷	•		<del>+</del>	$\frac{\perp}{}$	<u> </u>	<u>!!</u>	$\sqcup$	⊢
		Caliform Group	N/100 ML		4   0		<u> </u>		<u> </u>		<u> </u>			_
		Color	Pt - Ca	<del></del>	0 0		-		<u> </u>	1	<u> !</u>	<u> </u>	_	_
		Capper, Dissolved		0	<u> </u>	<u> </u>	-			<u> </u>	!		$\Box$	
_		Cyanide, Total	MG/L as CN	01		<u> </u>					<u> </u>	Ш		
	111	Endrin, Total	UG/L	3 19	9   3	9	0						_	
		Fluoride, Dissolved	MG/L as F	ala	9   0	15	0					.		
	111	Grass Alaha, Dissalved	Pc/L	0	1   5	0	13	1		1	<u> </u>		$\bot$	
		Gross Beta, Dizalved	Pc/L	0	3   5	0	3			<u> </u>				
1111111		Hardness, Total as CaCO <sub>3</sub>	MG/L	0   0	)   9	0	0	Ì				<u> </u>	$\perp$	
		Iran, Dissalved	UG/L as Fe	0   1	0	4	6	Ī	$\perp$					
11	XI	Lead, Dissolved	UG/L as 25	0   1	0	4	9	١	Ī				1	
111111	111	Lindane, Total	UG/L	3   9	1   7	8	2		1					
111111		Manganese, Dissolved	UG/L	0   1	0	5	6	Ī	Ī			<u> </u>		
IIIXIII	! ! !	Mercury, Dissalved	UG/L	7 1	la	! 9	0			1				
VALUE CODING RU	I ES AND			2			33 :	17				9	33 3	4
REMARK CODES ON			3	3			59 4 72 3	1					66 6 79 8	0

# NOITDETORS ADMINORIVE OF THEIR TRESO YESREL WEND TO THEIR RESOURCES. WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

PLEASE	TYPE OR PRIN	T NITH BALLPO	INT PEN	

FACILITY NAM	WE Unocal Chemi	cals - Carteret, NJ		8-WM	
LAB NAME		tories, Wappingers Fa	lls. NY		
	nipoes no.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT, NO.	WOM USE
S	N-0 0 2 6 0 7 7	216-018151519-3	8 9 0 2 0 7	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 10 8 8 8 TO 10 18 19 12

#### SUBMIT WITH SIGNED T-VWX-014

		s	سد	PLI	NC	M	0N	ТН	S						) (
. 4	4	M.	Apr.	Key	Ar no	1	Aug.	<b>Set</b>	061.	20	Dec.	ANALYSIS	UNITS	PARAMETER	VALUE
	T			П				Ī		T		Methaxychlar, Total	UG/L	3 9 4 8 0	
		1						Ī	1	Π	1	Methylene Blue Active Substances	MG/L	3 8 2 5 0	11.11
Г	T							Ī		Ī		Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	0 0 6 0 8 1	
Γ		П	I	Ī				Ī	I			Nitrogen, Nitrate Dissolved	MG/L as N	0 0 6 1 1 8 1	
Γ	Ī	П		Ī				1	ĺ	ĺ	I	Odor	T.O.N.	00085	1111
			X		Ì				Ĺ			Нс	Standard Units	00400	7 . 3 6
	1											Phenois, Total Recoverable	UG/L	3 2 7 3 10 !	
		ΠI				1	ļ		١.	Ī		Radium 225, Dissolved	Pc/L	0 9 5 0 3	
					Ī							Radium 228, Dissolved	Pe/L	8 1 3 6 6 1	
												Selenium, Dissolved	UG/L	0 1 1 4 5 1	1111
		Π	1			$\Box$	-					Silver, Dissolved	UG/L	0 1 0 7 5 !	1111
$\prod$		П	1	T	1	1	1	-				Sadium, Dissalved	MG/L	00930	1111
			X	1	Ĭ	T	1	Ì	Į			Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	01019461	
X			X			X			X			Total Dissolved Solids (TDS)	PPM	7 0 3 0 0 1 1	6 7 6
		1			Ī		Ī					Total Organic Carbon (TOC)	PPM	005801	
$\prod$			T	Ī	Ī	T	Ī	T		1		Total Organic Halogen (TOX)	UG/L	7 0 3 5 3 1	
П		1	Ī		1		Ī	Ī	ī	Ī	T	Toxagnene	UG/L	3 9 4 0 0 1	i
П	Ī				T	T	1	-	Ī	Ī		Turbidity	עדע	0 0 0 7 6 1	1111
	Ī		<	Ī	Ţ	j	Ī	Ī		- 1	$\exists$	Zinc, Dissolved	UG/L	0 1 0 9 0 1	1   1   1
	Ī	Ī	T	T	1	Ī	T	Ī	Ī	Ī	T	2, 4-0, Total	UG/L	3 9 3 7 0 1 1	
$\prod$	Ī	Ī	T	T		1	Ī	1	T	1	$\neg$	2, 4, 5—TP, Total	UG/L	3 9 0 4 5	
П	I	1	1	T	Ī		Ī		Ī	١	T				
П		j	T	1	İ	T	T	T	1	Ī	T			11111	T
П	T	1	1		I	T	T	Ī	T	1	1				
П	T		T	T	1	1	Ī	Ī	Ī	T	$\top$		i		1111
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T	Ť	Ī	ļ	Ť	İ	Ť	T	1	Ť	Ī	十				
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VALUE COOING RULES AND REMARK CODES ON REVERSE

## NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION CESSURCES STANDARD TO NOISIVIO

#### WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYPE OR PRINT WITH BALLPOINT PEN	

REMARK CODES ON REVERSE

FACILITY NA	unocalChemic	al _ Carteret, NJ		sw 10 NO. MW-8	
LAB NAMÉ	NANCO Labora	tories- Wappinger Fal	ls. NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LAB CERT. NO.	WOM USE
Ţ	un d q s e q y y	उब- व ब ब ब के 3	8 9 0 2 b 7	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0 18 8 18 TO 018 91 2

#### SUBMIT WITH SIGNED T-VWX-014

sampling months				Ank
Jan. Fab. Mar. Apr. June June Sapr. Oce.	ANALYSIS	UNITS	PARAMETER	E MARK
MIMIMIMI	Acrylanitrile	UG/L	3   4   2   1   5	2 5 K
	Benzene	UG/L	3 4 10 3 10	9 4 0 0
	3romotorm	UG/L	3 2 1 1 0 4	1 0 0 K
	Carbon Tetrachtoride	UG/L	3 2 1 0 2	1   0 !O   K
	Chiarabenzene	UG/L	3 4 3 0 1 1	1 1 0 0 0
	Chlorodibromoethane	UG/L	3 4 3 0:6	1   0   0   K
	Chloroform	UG/L	3 2 1 1 0 6	1 1 1 1 0 0 K
	1, 1 - Dichtgroethane	UG/L	3 4 4 9 6	1 1 1 1 1 0 0 K
	1, Z - Dichtorgethane	UG/L	3 4 5 3 1	1 1 1 1 0 0 K
	1, 1 - Dichloroethylene	UG/L	3 4 5 0 1	
	1, 2 · Dichloropropane	UG/L	3 4 5 4 1	1 0 0 K
	Emvibenzene	UG/L	3 4 3 7 1	1100 K
	Methylene Chloride	UG/L	3 4 4 2 3	5 710
	1, 1, 2, 2 - Tetrachtorpethane	UG/L	3 4 5 1 5	1 1100 K
	Tetrachioroethylene	UG/L	3 4 4 7 7 3	1 0.0 K
	Taluene	UG/L	3 4 0 1 1 . 2	100 K
	1, 1, 1 - Trichlorgethane	UG/L	3 4 5 0 5	1 ! 0 · 0   K
	1, 1, 2 - Trichloroethane	UG/L	3 4 5 1 1 1	1100 K
	Trichloroethylene	UG/L	3 9 1 8:0	11010   K
	Vinyl Chlaride	UG/L	3 9 1 1 7 5	1 1 0 0 K
	Acrolein	UGIL	314/211 0	
	Chloroethane	UG/L	314 3:1:1	110'0 K
	2 - Chloroemylvinyl Emer	UG/L	3 4 5 7 5	1 1100 K
	Dictionatramamethane	UG/L	3 2 1 0 5 1	1 1 110 0 K
	1, 3 - Dicatoropropylene	UG/L	3 4 6 9 9 1	1 0 0 K
	Metnyl Bromice	UG/L	3 4 4 1 1 3 1	! ! '110'0 K
	Metnyi Chiaride	UG/L	3 4 4 1 8	1 0.0 K
	1, Z - trans - Dichtgroethylene	UG/L	3141514.5	1 0;0 K
	1, 2 Dichtarabenzene	UGIL	3141513151	!   11010 K
11 1 1;1 1 1 1 1 1 1 1 1	1, 3 Dichtarapentene	UG/L	314 5:5:6 1	!! 110.0 K
	1, 4 Oichtaracenzene	UG/L	3141517 1	1: 110:0 K
VALUE CODING RULES AND REMARK CODES ON REVERS	2		29 J3 J4 42 46 47 53 59 40 68 72 73	40 41 53 54 45 57 79 60

Form YWX-017 4/823 P1

VALUE CODING RULES AND

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID. BASE/NEUTRAL ORGANIC COMPOUNDS

er BASE TY	E OR PR	INT MITH BALLPOIN	PEN			
FACILITY			1 Chesical - Carteret,	NJ	54 10 NO. MM-8	
LAS HAME	• •	NANCO Labora	tories - Wanningers Fa	lls NY		
Ū		12 6 0 7 7	26 08559-13	EAMPLE DATE TR.   MO.   DAT	TITLE CERT. NO.	MCM CZE

SUBMIT WITH SIGNED T-PWI-014

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 10 18 18 TE TO 101 8 9 7

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ıГ	1	T	1				Ł	1	1				2,4-Dichlorophenol	ug/l	_	-	-	-		11	-	<del> </del>	<u> </u>		Н	Н	$\vdash$	-
	T	T	T.										2.4-Dimethylphenol .	ug/1						6		╀		Щ	Ц	Н	- -	-
_1	丰	T	Ti					Ī	T				2,6-Dinitro-o-cresol	ug/1 .	_	_	_	-		3	_	$oldsymbol{\downarrow}$			$\sqcup$	$\square$	4	-
	T	T	Ti				Γ	T	T	1			2,4-Dinitrophenol	ug/1			_	_	_	6	Ļ	Ļ	Ц		_	_	4	-
<b>"</b> †	T	1	Ti					T	T	П			2-Nitrophenol	ug/1						1	L	上	Ш		ᆜ	_	$\bot$	_
_†	Ŧ	T	1:					Ī	T	II			4-Nitrophenol	ug/I···	_	_	_			9	_	Ļ	Ц	_	_	_	$\bot$	_
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<b>-</b>  -	Ť	T	T				Γ	T	Ť	Ħ			Pentachlorophenol '	ug/l	-	-	10	-	_	_		$oxed{oxed}$	Ш	_	ightharpoons	_	4	_
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▊Ͱ	+	÷	╁╴				<u> </u>	╁	t	1	i		Benzidine	ug/l	3	9	1	1	2	0	П	П		$\overline{\cdot}$			$\perp$	
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	+	÷	+	$\vdash$				╁	÷	┪	-		3,4-Benzofluoranthene	ug/1	3	4	2	1:	3	0		Π	Ī	T	T	1	T	
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	+	+	+	H		Н	_	╀	+	+	┪	ᅱ	Bis(2-chloroethoxy)methane	ug/1	3	_	-	÷	÷	_	一	$\sqcap$	Ī	丁	T	T	T	
_	+	+	+-		_			-	+	+	ᅻ	-	Bis(2-chloroethyl) Ether	ug/1	3	_	_	_	_	_	T	寸	Ť	Ť	T	T	T	
	+	+	+	$\vdash$		_		_	+	+	<u> </u>	-	Bis(2-chiroisopropyl) Ether	ug/1	3	_	<u> </u>	-	_	_	i	寸	Ť	寸	$\top$	ī	$\top$	
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#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT ... DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYPE OF PA	INT WITH BALLPOINT PEN	
FACILITY NAME	Unocal Chemicals - Carteret, NJ	54 10 NO. MW-8
LAC LME		

NANCO Laboratories - Wappingers Falls. ELMOLE DATE WELL PERMIT NO. NI LAB CERT, NO, WCH (EE RIFOES NO. TR. | MO. | DAT 向 890207

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 1018 818 TO 18 92

#### SUBMIT WITH SIGNED T. FWX-014

SAMPLING MONTHS	•			E X
441411414	AMALYES	UHITS	PARAMETER	ANTINE PROPERTY OF THE PROPERT
	Chrysene	ug/1	3 4 3 2 0	
	Dibenzanthracene	ug/1	3 4 5 5 6	
	1,2-Dichlorobenzene	ug/1	34536	
	1.3-Dichlorobenzene	ug/1	34566	
	1,4-Dichlorobenzene	ug/l	3 4 5 7 1	
	3,3'-Dichlorobenzidine	ug/1	3 4 6 3 1	
	Diethyl Phthalate	ug/1	3 4 3 3 6	
	Dimethyl Phthalate	ug/1	3 4 3 4 1	
	Di-n-butyl Phthalate	ug/1	39110	
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1	
	2,6-Dinitrotolulene	ug/l	3 4 6 2 6	
	Di-m-octyl Phthalate	ug/l	3 4 5 9 6	11111
	1.2-Diphenylhydrazine	ug/1	3 4 3 4 6	
	Fluoranthene	ug/1	34376	
	Fluorene	ug/1	3 4 3 8 1	
	Hexachlorobenzene	ug/1 -	397001	
	Hexachlorobutadiene	ug/1	3 4 3 9 1	
	Bexachlorocyclopentadiene	ug/l	3 4 3 8 6	
	Rexachloroethane	ug/1	3 4 3 9 6 1	
	Indenopyrene	ug/1	344031	
	Isophorope	ug/l	344081	
	Maph;halene	ug/l	3 4 6 9 6	
	Missabenzene	uz/1	344471	
	H-Mitrogodimentlyanine	uz/1	34433	
	H-Mitrosodi-n-propristine	ug/l	3 4 4 2 8	
	H-Hitrosodiphenylamine	ug/1	3 4 4 3 3 .1	
	Phenanthrene	· ug/l	3 4 4 6 2	
	Pyrene	ug/1	3 4 4 6 9 1	
	1.2.4-Trichlorobenzene	uz/1	3 4 5 5 1 1	
VALUE CODING RULES AND REMARK CODES ON REVER	_	· · · · · · · · · · · · · · · · · · ·	27 23 34 42 46 47 84 80 60 64 73 73	40 41 62 54 44 57 78 60

### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

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15	39 40	46 47
	•• ••	-3 40

## NEW JERSEY DEFARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

### MONITORING REPORT - TRANSMITTAL SHEET

NUPOES NO.

REPORTING PERIOD .

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[1:1|8:8| THE [0:1|8:9]

March 21, 1989

	Mancal Chemical Name  1345 North Meacham			
•	Schaumburg. IL  NameUnocal Chemicals Div  Address350 Roosevelt Avenue Carteret  Telephone(_201_) 541- 4224	e (County) Middlesex		
T-VWX-007  SLUDGE REPORTS - II  T-VWX-010A  WASTEWATER REPORT  T-VWX-011  GROUNDWATER REPORT  1 VWX-015(A,B)  NPDES DISCHARGE MC  EPA FORM 33	T-VWX-008 T-VWX-009  NOUSTRIAL T-VWX-0108  TTS T-VWX-012 T-VWX-013  DRTS T-VWX-015 T-VWX-017  DMITORING REPORT	OPERATORS EXCEPTIONS  DYETESTORS  TEMPORARY BYPASSING  DISIMPECTION INTERRUPTION  MONITORING MALFUNCTIONS  UNITS OUT OF OPERATION  OTHER  (Detail may "Yes" on reverse side in appropriate space.)  NOTE: The "Hours Attended at Placement of this sheet must also be con	ant" on the implessed.	
LICENSED OPERATO	information submitted in this doc of those individuals immediately i submitted information is true, acc penalties for submitting false info	It I have personally examined and am fourment and all attachments and that, but responsible for obtaining the information are that it is matter and complete. I am aware that it is matter in the possibility of first PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE Name (Prices).  Daryl W. Dierwecht Supervisor Priving	pased on my ion, I believ there are signe and impr	y ind ve th snifi
Grade & Registry No		Name (Prince)  Daryl W. Dierwech Supervisor Enviro Affairs	, <u>T</u>	

Date \_

OPERATING EXCEPTIONS DETAILED				
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#### HOURS ATTENDED AT PLANT

Month	1 1	Year	1 ,
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Day of Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Licensed Operator																
Others																
Day of Month	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	-
Licensed Operator																
Others														i	i	

# WATER QUALITY MANAGEMENT ELEMENT WATER QUALITY MANAGEMENT ELEMENT

				WATER QUALITY MANAGEMENT	CIMENI												
			GF	RU - 10 WATER ANALYSIS – MONITO	RING WELL R	EP	0	RT	•								
PLEASE TYPE	E DA PRIN	T WITH S	عمديه	POINTHEN													
FACILITY N.				• -		, SV	V 1(	) N	<del>0</del>	1.01		_				_	
LAB NAME	U	nocal	CR	eminal Carteret, NJ	<del></del>	<u> </u>				MW	<u> 1-9</u>						
	NANC	O Labo	prato	ories Wappingers Falls, NY													
	1	NJPOES I	NO		MO. I DAY	MI	, ,		-63	IT. 1	<b>V</b> O		ļ	[		usi	_
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1		174	U /	8 9 14 17	22	7	<u> 15</u>	14	ic	<u> </u>	7			L	<u> </u>	<u>.</u>	
THE SCHE	DULE INDI	CATED :	SELOV	WIS TO BE OBSERVED FROM 018 818 TO	0.89.2												
				MO. YE.	MO. YR.												
				SUBMIT WITH SIGNED T-VW	<u>r-014</u>												
SAMP	LING MON	VTHS															
A M E.	Key K	Sept.	ž č	ANALYSIS	UNITS	,	AF	laa	4E7	ER			VA	LU	E		
MIM	M	TM	T	Elevation of top of well casing with cap off	feet MSL:	Т	_				7		Ī	$\neg$	1	$\overline{}$	_
MIM	IVI	IN		(as specified in well completion report)	to nearest .01	$\perp$								او	<u>J</u>	8/9	)
X   X		IM		Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01	1								ام		ا ۵	
MIM	1 1	i M	-	Depth to water table from top of casing prior to	fees: to	١.	1,	5	T	6	H	+	Ť	Ť	Ī	7	1
MIN	IM	IN		sampling with cap off	nearest .01	ľ	<u> '</u>	=	"	10	⊥!			2 .	<u>.  </u> 1	5	
XIX	IX	IX		Depth to water table from original ground level prior to sampling	feet: to nearest .01	7	2	٥	1	9				2	.  6	6	
	1 i i		T	Arsenic, Dissolved	UG/L as As	0	11	0	lo	0	$\prod$	$\overline{1}$	$\Box$	T	T	T	7
	111	111	1	Barium, Dissolved	UG/L as 3a	0	1	0	lo	5		1	T	T	T	T	7
	111	i II.		Biochemical Oxygen Demand - 5 Day	MG/L	0	0	3	1	0		T	T	Ī	T	T	1
111	1 1	111	T	Cadmium, Dissolved	UG/L as Cd	0	1	0	12	5	П	T	T	T	T	T	T
XIX	IX	IX	1	Chlaride, Dissalved .	UG/L as CI	8	2	2	9	5		1  7	7	1/9	) 0	0	T
1111	111		110	Chromium, Dissolved	UG/L as Cr	0	1	0	3	0	Π	T	1	T	T	T	T
			1	Chromium, Dissolved, Hexavalent	US/L as Cr	0	1	2	2	0	I		T	Ī	T	1	Ţ
1111	1   1		1.0	Chemical Oxygen Demand (COO), Dissolved	MG/L	0	0	3	4	1	IT	T	T	T	T	1	T
1111	111	11	110	Caliform Group	N/100 ML	7	4	0	5	6		1	T	T	Ī	Ī	Ī
1111	1111		110	Calar	Pt · Ca	0	0	0	8	0	1	Ī	T	Ī	Ī	Ī	Ī
		11	TIC	Capper, Dissolved	UG/L as Cu	01	1	0	4	0	1	Ī	T	T		ī	Γ
1111	111		1 0	Zyanide, Total	MG/L as CN	01	0	7	2	0	T	$\top$	T	T	Ī	I	
i l i i	1111	11	1 =		UC ()	121		_	_		<u> </u>	7	T	$\overline{\top}$	T	1	Γ

	Cyanide, Total	MG/L as CN	[0]0]7[2]0[	1 1 1 1 1 1
	Endrin, Total	UG/L	0 6 2 6 2	
	Fluoride Dissolved	MG/L as F	ololeisio	1 1 1 1 1 1
	Grass Alona, Dissalved	Pa/L	011503	11111
	Grass Beta, Dimolved	Pe/L	0 3 5 0 3	11111
	Hardness, Total as CaCO <sub>3</sub>	MG/L	00191010	
	Iron, Dissolved	UG/L as Fe	0 1 0 4 6	
	Lead, Dissolved	UG/L as P5	0 1 0 4 9	
	Lindane, Total	UG/L	3 9 7 8 2	1 1 1 1 1
	Manganese, Dissolved	UG/L	0 1 10 5 5	111111
1   X   1   1   1	Mercury, Dissolved	UG/L	7 1 8 9 0	

VALUE COOING RULES AND REMARK CODES ON REVERSE

GROUND WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE	OR PRINT WITH BALLPOIN	nt pen			
FACILITY NA	ME Unocal Chem	icals - Carteret, NJ		5W 10 NG. MW-9	· · · · · · · · · · · · · · · · · · ·
LAB NAME		atories, Wappingers Fo	alls. NY		
·	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR. 1 MO. 1 DAY	NJ LAB CERT, NO.	WOM USE
S	N=0 0 2 6 0 7 7	26-08560-2	8 9 0 2 0 6	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO SE OBSERVED FROM 101 8 8 8 TO 18 19 12 1 NO. YR.

SUBMIT WITH SIGNED T-VWX-014

4	F.b.	Mar.	Apr.	May	June	July	Aug.	Sept			D	ANALYSIS	UNITS		PA	A.	AM	εT	FA	•			V.	LU	ı E		
7	Ī		$\overline{}$		_	1	$\overline{\Gamma}$	T .	T	T	T	Methoxychior, Total	l ug/L		_	_	4		_		Ŧ	ī	<u> </u>	7	_		_
7					_		$\vdash$	十	÷	†	†	Methylene Blue Active Substances	MG/L		_	_	12	_	_	-	+	十	十	ᅷ	$\dashv$	<del>+</del>	-
j				i	_			i	T	t	Ĺ	Nitrogen, Ammonia, Dissolved NH <sub>2</sub> + NH <sub>4</sub> as N		_	_	_	6	_		_	÷	十	十	Ť	寸	$\dot{ o}$	-
i		i		i				İ	İ	†	<del>i</del>	Nitrogen, Nitrate Dissolved	MG/L as N	$\rightarrow$		_	6		<u> </u>	_	÷	Ť	十	十	+	i	-
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Ϊ	Ì	Ĭ		İ					Ī	Ì	İ	Phenois, Total Recoverable	UG/L		_	_	7		_	-	Ť	Ť	Ť	Ť	Ť	Ţ	-
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Ī	1	$\top$	T	Ī	-					1.	Π	Radium 229, Dissolved .	Pe/L	8	1	ī	3	6	6	T	T	Ť	Ť	Ť	Ť	1	_
Ī	可	-	Ī	1		T				Γ		Selenium, Dissolved	UG/L	0	T	ıŢ	1	4	5	T	T	T	T	T	T	1	_
Ī	1	Ī	1	1	-							Silver, Dissalved	UG/L	0	į 1	1	a !	7	5	T	T	Ī	T	T	T	Ī	-
Ī	Ī	I	T		Ī	Ī		1				Sadium, Dissaived	MG/L	0	10	) į	9;	3	0	T	T	T	Ī	T		T	
	1	1)	X	T	Ī	ı						Sulfate, Dissolved (as SO <sub>4</sub> )	MG/L	0	lo	γi	9	4 ,	6	Γ	T	ī	T	T	T	!	
	1	1)	X;	Ī		X			X			Total Dissolved Solids (TOS)	Po-W	7	io	īŢ:	3 j	o:	0		1	[	ī	19	13	3 4	<u> </u>
	Ī	1	Ī	ī	1	Ī	Ī	Ī	Ì			Total Organic Carbon (TOC)	PoM	0	0	1	<b>5</b> :	a :	٥			Ī	Ī	1	T	Ţ	-
	Ī		1	1	1	T	1	-	1			Total Organic Halogen (TOX)	UG/L	7	a	īĪ:	3 ;	5	3		Ī	Ī	Ī	ī	ī	T	-
	Ī		T	T	Ī	Ī	1	Ī	1			Toxagnene	UG/L	13	9	1.	4 !	οi	0			!	Ī	Ī	T	i	-
	T		T	T	Ī	T		Ī	Ī	-		Turbidity	NTU	0	0	To	<b>3</b>	7 :	ō	Γ	Ī	i	Π		1	į	
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### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION CEDRUOZES STAND NOISINIO WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYPE	E OR PRINTWITH BALLPOIN	T PEN			
FACILITY N	unocalChemic	al_Carteret, NJ		SWID NO MW-9	
سة ٨٨٨٤	NANCO Labora	stories- Wappinger Fal	ls. NY		
	nipoes no.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LAB CERT, NO.	EZU MDW
Ţ	MJ d d y e d y y	2 6 -0 8 5 6 0 -2	8 9 0 2 0 6	13 4 4 4	23

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 0 18 8 18 TO 018 91 2

#### SUBMIT WITH SIGNED T-VWX-014

sampling months		<del></del>		LIPKS
Jan. Kat. Mar. Ant. Aut. Aut. Nov.	ANALYSIS	UNITS	PARAMETER	ATINE ANTRA
MIMIMIM	Acrylanitrile	UG/L	3 4 2 1 5	
	Bentane	UG/L	3 4 10 13 10	4  1  9
	Bromotorm	UG/L	3 2 1 1 0 4	1:0 K
	Carbon Tetrachloride	UG/L	3 2 1 1 0 2	1 10 K
	Chloropenzene	UG/L	3 4 3 0 1	
	Chlorodibromoethane	UG/L	3 4 3 0 6	1 0 K
	Chloroform	UG/L	3 2 1 1 0 1 6	110 K
	1, 1 - Dichtgroethane	UG/L	3 4 4 9 6	
	1, 2 · Dichtoroethane	UG/L	3 4 5 3 1	1 1 1 1 1 0 K
	1, 1 - Dichlaroethylene	UG/L	3 4 5 0 1	
	1, 2 - Dichloropropane	UG/L	3 4 5 4 1	110 K
	Emvibenzene	UG/L	3 4 3 7 1	2 5 0
	Methylene Chloride	UG/L	314 4 2 2 3	110 K
	1, 1, 2, 2 - Tetrachtorpethane	UG/L	3 4 5 1 5	1 1 1 0 K
	Tetrachioroethylene	UG/L	3 4 4 7:5	1 0 K
	Taluene	UG/L	3 4 0 1 2	8 9 0 0 C
	1, 1, 1 - Trichloroethane	UGIL	3 4 5 0 5	1 0 K
	1, 1, 2 · Trichtoroethane	UG/L	3 4 5 1 1 1	1 1 0 K
	Trichlaraethylene	UG/L	3 9 1 3 0	1   1   0   K
	Vinyl Chlorice	UG/L	3191117 5	1:0K
	Acraiein	UGIL	31412110	
	Chloroethane	UG/L	314:3::,1	: 4:10
	2 - Chlargemylvinyl Emer	טפור	3 4 5 7 6	1 1 1 1 0 K
H I mi I III I id I	Dichiarapromamethane	UG/L	3 2 1:0:5	1 1 1 0 K
	1, 3 - Dichtargargaytene	UG/L	314 6 9 9 1	1 0 K
	Methyl Bromide	UG/L	3 4 4 1 1 : 3 1	1 0 K
	Methyl Chlorice	UG/L	3 4 4 1 1 3	1.0 K
111 1 11: 1 11: 1	1, 2 - trans - Oichtorgethylene	UG/L	314:5;4.5 i	1 0 K
11 1 111 1 111 1 111 1	1, 2 Dichigrabenzene	UGIL	314151315	: :     1   0   K
11 1 1 1 1 1 1 1 1 1 1 1	1, 3 Dichtoropentene	UG/L	31415; 5. 5 1	1 1 0 K
	1, 4 Dichtaragenzene	UG/L	31415,711:	1 1 1 0 K
VALUE COOING RULES AND	-		29 33 14 42 46 47 33 39 70 46 72 73	40 -1 31 3- 52 37 73 40

REMARK CODES ON REVERSE

Farm YWX-017 USD

Pl

VALUE CLOING RULES AND

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

WATER QUALITY MANAGEMENT ELEMENT

### GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TY!	E OR PRINT M	TH BALLPOINT	PIN		ISW 10 NO	
FACILITY A			l Chemical - Carteret,	NJ	MW-9	
LAS HAME	- NAI	NCO Laborat	ories - Wappingers Ea	lls NY		
Ō		ES MO.	26-0856d-2	17 9 0 2 0 6	7 3 4 6 0	MCW (ZE
		•	to olo	in Inglad		

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 1018/818 TO 1018/9/4

### SUBMIT WITH SIGNED T-FWX-014

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F	T		त	T	T	T	T	X	T	T	T	2-Chlorophenol	ug/1		-	-	_	_	<u> </u>	-	上	Ц		_	1	Ш
1	T	ΙŤ	T	$\top$	T	F	T	T	T	T	T	2,4-Dichlorophenol	ug/1	<del></del> -	-	-	_	_	1	-	$oldsymbol{\perp}$	Ц		$\downarrow$	$\bot$	Ц
+	Ť		T	$\top$	Ť	T	T	1:	T	T	T	2,4-Dimethylphenol .	ug/1	_	_	_			16	_	L	Ш		$\perp$	$\perp$	Ц
r			1	T	T	$\top$	T		T	I	1	2,6-Dinitro-o-cresol	ug/1 ·			_	_	_	3	_	Ļ	Ц	1	1	_	Ц
			Ī	T	T	Ī	Γ	Ti	Γ	T	T	2,4-Dinitrophenol	ug/1	_	_	_	_	_	6	_	Ļ		_	1	<u> </u>	Н
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<b>T</b>			T	1	T	Ī	Ī	Ti	Τ	T	T	4-Nitrophenol	ug/I··			-	_	_	9	-	Ļ	Ц	_	_	<u> </u>	Ц
1			Ť	Ť	T	T	Γ	TI	Γ	1.	T	p-Chloro-a-cresol	ug/l	_	-	-	_	_	2				1	1	$\perp$	Ц
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		i	T	Ť	Ť	Ť	İ	i	Γ	T	1	Bis(2-chloroethoxy)methame	ug/l	3	4	1:	2	7	8	$\square$		1		1		Ц
$\vdash$			$\dagger$	T	T	†	İ	İ	İ	Ť	†	Bis(2-chloroethyl) Ether	ug/l	3	4	12	2	7	3			1	1	$\perp$		Ц
+			Ť	Ť	$\vdash$	T	İ	İ	İ	Ť	T	Bis(2-chlroisopropy1) Ether	ug/l	3	4	12	2	8	3			1	<u> </u>	<u> </u>	$\sqcup$	_
t			i	<del></del>			<u> </u>		<u> </u>	Ī	T	Bis(2-ethylhexyl) Phthalate	ug/l	3	_	-		_	_			1		1		$\perp$
		1	T	Ì	İ	i	Ī	T		Ī	T	4-Brozophenyl Ether	ug/l.	3	4	16	1	3	6	$\sqcup$		1	1	Ļ		_
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Fem VWX-017 4/83 P2

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT DIVISION OF WATER RESQUECES WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYPE	e or print mith Ballpoin	TPEN			
FACILITY M.	Unocal Chem	icals - Carteret, NJ		5W 10 NO. MW_9	
LAC SHE	NANCO Labor	atories - Wappingers F	alls. NY		
	AUPDES NO.	WELL PERMIT NO.	EAMOLE DATE . TR.   MO.   DAT	NI LAS CERT. NO.	HCH USE
Ō	NJ0 0 2 6 0 7 7	26-08560-2	890206	73460	

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0 18 18 TO 018 91 2

#### SUBMIT WITH SIGNED T-TWX-014 REMARKS SUPPLIES MONTHS UNITE PARAMETER VALUE ANALYSIS 3 4 3 2 0 ug/l Chrysene 3/4/3/5/6 ug/l Dibenzanthracene 3 4 5 3 6 ug/l 1.2-Dichlorobenzene 4 5 6 6 ug/l 1,3-Dichlorobenzene ug/l 4 5 7 1 1.4-Dichlorobenzene 4 6 3 1 ug/l 3.3'-Dichlorobenzidine 3 4 3 3 6 ug/l Diethyl Phthalate 3 4 3 4 1 Dimethyl Phthalate ug/l - 1-1 3 9 1 1 1 0 ug/1 Di-n-butvl Phthalate <u>ug/1</u> 3 4 6 1 1 1 2.4-Dimitrotolulene 3 4 6 2 6 2,6-Dinitrotolulene ug/l ug/l 3 4 5 9 6 Di-moctyl Phthalate 1 1,2-Diphenylhydrazine uz/1 3 4 3 4 6 3 4 3 7 6 ug/1 ŀ Fluoranthese 3 4 3 8 1 ug/1 Fluorene 3 9 7 0 0 ug/l Hexachlorobenzene Hexachlorobutadiene ug/1 3 4 3 9 1 3 4 3 8 6 ug/1 Hexachlorocyclopentadiene 3 4 3 9 6 ug/1 Rexachloroethane ug/1 3 4 4 0 3 Indenonyrene ug/1 4 4 0 8 Isophorope 4 6 9 6 ug/1 Maphthalene 4 4 7 ug/1 Missabenzene <u>v2/1</u> W-Wienegadinenelyanine 3 4 4 2 8 ug/1 N-Mittosodi-n-propylatine 4 4 3 3 ug/l N-Nicrosodiphenylamine · uz/1 4 4 6 1 Phenanthrene 13 14 14 16 19 ug/1 Pyrene D 4 |5 |5 |1 ug/l 1.2.4-Trichlorobenzene

40 41

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VALUE CODING RULES AND REMARK CODES ON REVERSE

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

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## DIVISION OF WATER RESOURCES

### MONITORING REPORT - TRANSMITTAL SHEET

NUPDES NO.

REPORTING PERIOD .

[0:0:2:6:0:7:7] [1:1 | 8:8] THE [0:1|8:9]

PERMITTEE:	Mnocal Chemical			
	Address 1345 North Meacham R	oad		
	Schaumburg, IL	60196		
FACILITY:	Name	ision		
	Address350 Roosevelt Avenue			
	Carteret	(County) Middlesex		
	Telephone <u>( 201 ) 541- 4224</u>			
FORMS ATTACH	ED (Indicate Quantity of Each)	OPERATURG EXCEPTIONS	-	
SLUDGE REPORTS			YES	NO
T-VWX-007	T-VWX-008	DYETESTONG		
SLUDGE REPORTS		TEMPORARY EYPASSING		
T-VWX-010		DISIMPECTEM INTERRUPTION		$\Delta$
<u> </u>		MONTTORNEG MALFUNCTIONS		$\mathbf{x}$
WASTEWATER REM		UNITE OUT OF OPERATION		
T-VWX-011	T-VWX-012 T-VWX-013	ОТНЕЯ		XI
GROUNOWATER RE	PORTS	(Detail any "Yes" on reverse side		
1 VWX-015(A.	3) 1 VWX-016 1 VWX-017	ін <del>аругаднісах</del> space.)		
NPOES DISCHARGE	монітоянь в <del>сро</del> ят 1320-1	NOTE: The "Hows Assended as Planeway of this sheet must also be con		ie '
AUTHENTICATION	of those individuals immediately results submitted information is true, acceptable.	I have personally examined and am faument and all attractments and that, baseponsible for obtaining the information rate and complete. I am aware that the mation including the possibility of fine	ssed on a on, I beli here are	my incu ieve the signific
LICENSED OPERA		PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE		
Name (Printed)		Name (Pricera) Daryl W. Dierwecht Supervisor Environ	er mental	
Grade & Registry No		ignature Affairs	1/1	
Signature		ignature Ag-1/1 Allich	ilte	
Date		March 21 1999		

OPERATING EXCEPTIONS DETAILED			
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#### HOURS ATTENDED AT PLANT

Month	للا	Year	
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Day of Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Licensed Operator		Π				I	I									
Others																
Day of Month	17	18	19	20	21	22	23	24	25	25	27	28	29	30	31	
Licensed Operator																
Others	Ī									Ī		Ī				-

## W JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION OIVISION OF WATER RESOURCES

#### WATER QUALITY MANAGEMENT ELEMENT

#### GRU U WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT WITH 3.	IALLPOINT IEN
------------------------------	---------------

FACILITY N	AME Unocal Chem:	tal Carteret NJ		SW 10 NO MW-10	
EMAN BL		s, Wappingers Falls	NY.		
	NJPDES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT. NO.	WQM USE
P	Mn d q q q q q x x	2 6 -0 8 5 6 1 -5	8 9 0 2 0 6	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO 35 OBSERVED FROM 0 18 8 18 TO 018 912

	MQ. YE.	MO. YE.		
	SUBMIT WITH SIGNED T-VWX	-014		
Sampling months				
Fab. May A	ANALYSIS	UNITS	PARAMETER	VALUE
MIMIMIMI	Elevation of top of well casing with cap off las specified in well completion report)	feet MSL: to nearest .01		10.32
MININIK	Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01		10.83
MINIMIKI	Depth to water table from too of casing prior to sampling with cap off	feet: to nearest .01	8 2 5 4 6	2.40
XIXIXIXI	Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	2   9   1
	Arsenic, Dissolved	UG/L as As	011000	
1 1 1 1 1 1 1 1 1	Barium, Dissolved	UG/L as 3a	011005	11111
	Biochemical Oxygen Demand - 5 Day	MG/L	0 0 3 1 0	
	Cadmium, Dissolved .	UG/L as Cd	0 1 0 2 5	
MINIMINI	Chlariae, Dissalved	UG/L as CI	8 2 2 9 5	1 2 1 9 0 0
	Chromium, Dissolved	UG/L as Cr	0 1 0 3 0	111111
	Chromium, Dissolved, Hexavalent	UG/L as Cr	0 1 2 2 0	
11111111	Chemical Oxygen Demand (COD), Dissolved	MG/L	0 0 3 4 1	
	Caliform Group	N/100 ML	7 4 0 5 6	
	Calar	Pt - Ca	ololololo	
	Capper, Dissalved	UG/L as Cu	0 1 0 4 0	
	Cyanide, Total	MG/L as CN	0 0 7 2 0	
	Endrin, Total	UG/L	3 9 3 9 0	
	Fluoride, Dissolved	MG/L as F	0 0 9 15 0	
	Grass Alama, Dissalved	Pc/L	01150131	
	Gross Beta, Dimolved	Pc/L	0 3 5 0 3	
	Hardness, Total as CaCO <sub>3</sub>	MG/L	000191000	
	Iran, Dissalved	UG/L as Fe	0 1 0 4 5	
	Lead, Dissolved	UG/L as 25	0 1 0 4 9	
	Lindane, Total	UG/L	3 9 7 8 2	
	Manganese, Dissolved	UG/L	0 : 10 5 6	
	Mercury, Dissolved	UG/L	7 1 8 9 0	
			9 33 34	40 • .

ONA SELUT DNICCO BULAND SEREVER NO SECON REVERSE

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

#### Page 2

								S THEMSDAKEM YTIJAUD RETAW	LEMENT		
							C	GROUND WATER ANALYSIS - MONITO	RING WELL A	REPORT	
PLEASE TYP	e qa	29	INT	NI	ITH	, 9.	ے ر	LPOINT PEN			
FACILITY N	A.ME		Ü	no		 al	0	hemicals - Carteret, NJ		SW 10 NO. MW-10	
LAB NAME										114-10	
			N	A	AL L	1_		<u>aboratories, Wappingers</u> Fal <u>ls. NY</u>	LE DATE		
			N	JPC	2€5	5 N	О.		MO.   DAY	NJ LAB CERT, NO.	WOM USE
<u>s</u>	N.	40	0	2	6	lo	17	7 26-018561-5 819	0 2 0 6	7 3 4 6 0	
7		7						16 17	22	23 27	23
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								SUBMIT WITH SIGNED T-PWX	.014		
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	PLIN				_			_			
Jan Fab. Mar. Apr.	¥ 4	Je y	Aug	ž	Oct.	Š	d	ANALYSIS	UNITS	PARAMETER	VALUE
		Τ				Γ	Ī	Methaxychior, Taui	UG/L	3 9 4 8 0	TITIT
								Methylene Blue Active Substances	MG/L	38260	11111
				- 1			I	Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	0 0 6 0 8	11111
								Nitragen, Nitrate Dissolved	MG/L as N	0 0 6 1 8 1	11.11
								Odor	T.O.N.	00085	
IIX								Нс	Standard Units	004001	1   6   .   8   7
				1	Î			Phenois, Total Recoverable	UG/L	3 2 7 3 10 !	1 1 ! ! !
			ļ	1	-			Radium 225, Dissolved	Pc/L	09503	i
								Radium 229, Dissolved	Pe/L	8 1 3 6 6	
				-	Ī	-[		Selenium, Dissolved	UG/L	0 1 1 4 5	
						$\Box$		Silver, Dissolved	UG/L	0 1 0 7 5	
				-		1		Sadium, Dissalved	MG/L	009301	
IIX		Ī		Ĭ	Ī	Ī		Sulface, Dissolved (as SO <sub>4</sub> )	MG/L	0 0 9 4 6 1	
XIX		X		1)	X	Ī		Tatal Dissalved Salids (TOS)	29M	7 0 3 0 0 1 1	
TITI	11	Ī	Ī	Ī	Ī	T		Total Organic Carbon (TOC)	PPM	0 0   6   8   0	1111
1111		1		T	Ī	1	T	Total Organic Halogen (TOX)	UG/L	7 0 3 5 3 1 1	1111
1 1 1 1	1 1	$\overline{}$	1		÷	÷	-	•			<del></del>

VALUE CODING RULES AND REMARK CODES ON REVERSE		23 42 55 64			39	2 34 6 47 9 40 2 73					\$ 4 :	13
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	UG/L	3	9	31	7 ! 0	,	Ī	1		- 1	1	
Zinc, Dissolved	UG/L	ai	1	g:	9   (	<u>,                                    </u>	i	Ī				
Turbidity	טדא	0	a	0	7	5	Ī				Ī	
Tozagnene	UG/L	3	9	4	a l	<b>1</b>	T	Ţ		!	i	
Total Organic Halogen (TCX)	UG/L	7	a	3	5 i .	3				1	i	

## POITOSTOPS ATMEMBORIVES OF TRANTRACES VESESL WEN AD MOISIVIO

WATER CUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYPS	OR PRINT WITH BALLPOINT PEN	

FACILITY NAME	UnocalChemic	5.V 10 NO MW-10			
LAB NAMÉ	NANCO Labor	atories- Wappinger Fal	ls. NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LAB CERT. NO.	NOM USS
LN T	0026077	2 6 -0 8 5 6 1 5	8 9 0 2 0 6	7 3 4 8 0	

THE SCHEDULE INDICATED SELOW IS TO SE OBSERVED FROM U. YR. TO NO. YR.

#### SUBMIT WITH SIGNED T-VWX-014

Feb. Mer. May May May Ner.	Y ANALYSIS	ZTINU	PARAMETER	VALUE
	T	l ug/L	714171115	
	Acrylonitrile		3 4 2 1 5	1
	Benzene	UG/L UG/L	3 4 0 3 0	
	Bromotorm		3 2 1 0 4	1   1   1 - 1 (
	Carbon Tetrachtoride	UG/L	3 2 1 0 2	1 1 1 -! (
<del>                                     </del>	Chiaracenzene	UG/L	3 4 3 0 1	9  1
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Chlorodibromoethane	UG/L	3 4 3 0 6	1 -  0
<u> </u>	Chloroform	UG/L	3 2 1 0 6	1 1 1 1 .1 (
<u> </u>	1, 1 - Oichtoroethane	UG/L	3 4 4 19 6	1 1 111.0
1 1 11 1 1 1 1 1 1 1	1, 2 - Dichtorgethane	UG/L	314 5 3 1	<u> </u>
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1, 1 - Dichtaroethylene	UG/L	314 5 0!1	1       111.10
<u>                                     </u>	1, 2 - Dicaloropropane	UG/L	3 4 5 4 1	1   11.10
<del>                                     </del>	Ethylbenzene	UG/L	3 4 3 7 1	
<u>                                     </u>	Methylene Chloride	UG/L	3 4 4 2 3	1 .10
	1, 1, 2, 2 - Tetrachloroemane	UG/L	3 4 5 1 6	1    11.10
	Tetrachioroethylene	UG/L	3 4 4 7:5 1	11.0
	Taluene	UG/L	3 4 0 1 2	5 4.7
	1, 1, 1 - Trichlorpethane	UG/L	3 4 5 0 5 !	1 111.0
	1, 1, 2 · Trichtoroethane	UG/L	3 4 5 111 1	11.0
1 1 1 1 1 1 1 1 1 1 1 1	Trichloroethylene	UG/L	3 9 1 8:0	11.10
1 111 1 111 1 111 1	Vinyl Chlaride	UG/L	3 9 11 7 5 1	11.0
1 11 1 1 1 1 1 1 1 1	Acrolein	UG/L	31412110	12:5
1 11: 1 11: 1 11: 1	Chlorostrane	UG/L	314 3:1:1	8.1
1 11: 1 11: 1 11: 1	2 - Chloroethylvinyl Ether	UG/L	3 4 5 7 6 1	1 1 11-10
1 11: 1 111 1 11 1	Dichloropromomethane	UG/L	3 2 1:0:5	: 11.0
1 11 1 1 1 1 1 1 1 1	1, 3 - Dichtargarpaytene	UG/L	314 6:913	11.0
1 11 1 1 1 1 1 1 1 1	Methyl Bramide	UG/L	3 4 4 1 1 3 :	1 ! 11.0
1 11 1 1 1 1 1 1 1 1	Metnyl Chlorice	UG/L	314141118	11.0
1 1/2 1 1/1 / ///	1, 2 - trans - Dichtorgethylene	UG/L	3!4 5,4 5   i	: 11.0
1 11   1 11 1 11 1	1, 2 Oichtarabenzene	UG/L	3141513!5	: 111.0
I live to the property	1, 3 Dichtoropenzene	uG/L	31415; 5.5	11.0
1 1 1 1 1 1 1 1 1 1 1	1, 4 Dichtorogenitene	UG/L	29 13 24 42 46 47 13 29 50 48 72 73	11.0

Form YMX-017 UE3 P1

# MEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID. BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TY	PE OR PRINT MITH BALLPOIN	TPEN		ISW ID NO.	
FACILITY !	Unoc	, NJ	MW-1	0	
LAS HAME	· - NANCO Labora	itories - Wappingers E	alls NY		
Ū	N. 10 0 2 6 0 7 7	26-085615	890206	7 3 4 6 0	MCM (ZE

THE ECHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 1018 818 TO 18 10 12

SUBHIT WITH	SIGNED	T- FWI-014

SAMPLING MONTHS	•	_		A
1211111111111	ANALYES	инта	PARAMETER	ANTHE P
TINTI NI	2-Chlorophenol	ug/1	34586	
	2,4-Dichlorophenol	ug/1	346011	
	2,4-Dimethylphenol .	ug/1	34606	11111
	2,6-Dinitro-o-cresol	ug/1 .	77603	
	2,4-Dimitrophenol	ug/1	346116	
	2-Nitrophenol	ug/1	3 4 5 9 1	
	4-Nitrophenol	ug/I··	3 4 6 4 9	
	p-Chloro-a-cresol	ug/l	3 4 4 5 2 1	
	Pentachlorophenol '	ug/l	39032	1 1 1 1 1
	Phenol	ug/1	3 4 6 9 5 1	
	2.4,6-Trichlorophenol	ug/l	3 4 6 2 1 1	
			1	
	Acareshena	uz/1	3/4/2/0/5/	11111
	Acenaphthylene	ug/l	3 4 2 0 0 1	11111
	Anchracene	ug/l	3 4 2 2 0 1	111.11
	Benzidine	ug/1	3 9 1 2 0	
	Benzanthracene	ug/1	3 4 5 2 6 1	1 1 1 1 1
	Benzapyrene	ug/1	3 4 2 4 7 1	
	3,4-Benzofluoranthene	ug/1	3 4 2 3 0 1	1
	Benzaperylene	ug/1	3 4 5 2 1	
	Benzofluoranthene	ug/1	3 4 2 4 2 1	
	Bis(2-chloroethoxy)methane	ug/l	3 4 2 7 8 1	
	Bis(2-chloroethyl) Ether	ug/l	3 4 2 7 3 1	
	Bis(2-chlroisopropyl) Ether	ug/l	3 4 2 8 3 1	
	Bis(2-ethylhexyl) Phthalate	ug/1	3 9 1 0 0 1	
	4-Brozophenyl Ether	ug/l .	3 4 6 3 6 1	
<del>▐▕▕▕▕▕▕▕▕▕▕▕</del>	Butvlbenzyl Phthalate	ug/l	3 4 2 9 2	
	7-Chloronanhchalene	uz/1	3/4/5/2/1	11111
	4-Chlorenhenyl Phenyl Ether	ug/1	3 4 6 4 1 1	
			29 23 24	40 41

Fem VWX.017 4/83 P2

SAMPLING MONTHS

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT : DIVISION OF WATER RESDURCES WATER QUALITY MANAGEMENT ELEMENT

#### GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYPE	' or print mith Ballpoin	T PEN			
FACILITY NA	Unocal Ches	SW 10 NO. MW-10	)		
LAC . AME		atories - Wanningers F	alls. NY		
•	NJPOES NO.	WELL PERMIT NO.	SANGLE DATE . TR.   MG.   DAT	NJ LAS CERT, NO.	WCM LEE
	44939900ru	26-08561-5	890206	73460	

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 0 18 18 18 TO 0 18 9 7

#### SCIMIT WITH SIGNED T-TWX-014

1111111111	AHALYES	UNITE	PARAMETER	VALUE						
	Chrysene	ug/1	34320	TTTT						
	Dibenzanthracene	ug/l	3 4 5 5 6							
	1,2-Dichlorobenzene	ug/l	34536	7.7.7.7.7.7.7						
	1.3-Dichlorobenzene	ug/l	3 4 5 6 6							
	1,4-Dichlorobenzene	ug/1	3 4 5 7 1							
	3.3'-Dichlorobenzidine	ug/1	3 4 6 3 1							
	Diethyl Phthalate	ug/1	34336							
	Dimethyl Phthalate	ug/1	3 4 3 4 1							
	Di-n-butyl Phthalate	ug/l	3 9 1 1 0 1							
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1							
<u> </u>	2,6-Dinitrotolulene	ug/l	3 4 6 2 6							
	Di-m-octyl Phthalate	ug/1	3 4 5 9 6							
	1,2-Diphenylhydrazine	ug/1	3 4 3 4 6 1							
	Fluoranthene	ug/1	3 4 3 7 6 1							
	Fluorene	ug/1	3 4 3 8 1							
	Hexachlorobenzene	ug/1	397001							
	Hexachlorobutadiene	ug/l	3 4 3 9 1							
	Bexachlorocyclopentadiene	ug/1	3 4 3 8 6							
	Rexachloroethane	ug/1	3 4 3 9 6 1							
	Indenopyrene	ug/1	344031							
	Isophorope	ug/1	3 4 4 0 8 1							
	Maphthalene '	ug/1	3 4 6 9 6							
	Mitrabenzene	ug/1	344471							
	H-Wittnesdimentlys-ine	22/1	3 4 4 3 9 1 1							
	N-Mitrosodi-n-propylamine	ug/1	3 4 4 2 8 1 1							
	N-Nitrosodiphenylamine	ug/l	3 4 4 3 3 .							
	Phenanthrene	- ug/l	3 4 4 6 1 1							
	Pyrene	ug/1	3 4 4 6 9 1							
	1,2,4-Trichlorobenzene	ug/l	1 4 5 5 1 1 1							

70 11 14

VALUE CODING RULES AND REMARK CODES ON REVERSE

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT SI EMENT

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FACILITY	NAME	,		Ü	nocal c	Chemic	ale	۲.			1			SW 10 NO MW-10													
LAB NAME	<del></del>																	M	<u>( - 1</u>	<u>U</u>							
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## MONITORING REPORT - TRANSMITTAL SHEET

NIFOES NO.

REPORTING PERIOD .

MG. YR. MG. YR.

0101216101717] [111818] THEO [011819]

PERMITTEE:	Mnocal Chemical			
_	Address 1345 North Meacham	Road		
	Schaumburg, IL	60196		
FACILITY:	NameUnocal Chemicals D	livision		
	Address 350 Roosevelt Aven	ue		
	Carteret	(County) Middlesex		
	Telephane <u>(201) 541-4224</u>	• • • • • • • • • • • • • • • • • • • •		
FORMS ATTACH	HED (Indicate Quantity of Each)	OPERATOR EXCEPTIONS	-	
SLUDGE REPORTS	S-SANITARY		234	NO
T-VWX-00	7 T-VWX-008 T-VWX-009	DYETESTORS		$\nabla$
SLUDGE REPORTS	- INOUSTRIAL	DNIZZAYE YRARCEGT		
T-VWX-010	2AT-VWX-010B	DISIMPECTON INTERRUPTION		<b>&amp;</b>
WASTEWATER REA	PORTS	MONTORES MALFUNCTIONS		<u> </u>
T-VWX-011		UNITS OUT OF OPERATION OTHER		E E
GROUNDWATER R	.B1 1 VWX-016 1 VWX-017	(Devil ery "Yes" on reverse side in e <del>pperation</del> space.)		
NPDES DISCHARGE	: монітоя нід я <i>єр</i> оят 3320-1	NOTE: The "Hows Attended at PL revorse of this sheet must also be con		ie
AUTHENTICATIO	of those individuals immediately submitted in this double of those individuals immediately submitted information is true, a	hat I have personally examined and am facument and all amothments and that, by responsible for obtaining the information courate and complete. I am aware that the formation including the possibility of fin	ased on a on, I bel here are	my incu ieve the signific
Licensed opera	STOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE	į	
Name (Printed)		Name (Area) Daryl W. Dierwech	ıter	
Grade & Registry No	o	Supervisor Environment Affairs	nmenta ^	
Signature		Signature Day A Michigan	the	
Date		OateMarch_211989		

PERATING EXCEPTIONS DETAILE	<u>D</u>																	
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Others																	1	
Day of Month	17	18	19	20	21	22	23	24	25	25	27	28	29	30	31		İ	
Licensed Operator																		
Others																	Í	

## W JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

### WATER QUALITY MANAGEMENT ELEMENT

## GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

FACILITY NAM	Unocal Chem	tal Carteret N.1		SW 10 NO MW-11	
LAB NAME		es. Wappingers Falls	NY		
	NIPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT, NO.	WOM US
R	rkppkpph	26-08562-3	8 9 0 2 0 6	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO SE OBSERVED FROM 018 8 8 8 TO 0 18 9 12 MG. YE.

## SUBMIT WITH SIGNED T-VWX-014

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Jan.	ž ž	Apr.	<u>`</u>	و ما باط	<b>A</b>	Sept.	061	Now	0	ANALYSIS	UNITS		PA	LA	**	467	rea			٧	ALI	IJξ		
M		M		X			X			Elevation of top of well casing with cap off (as specified in well completion report)	feet MSL: to nearest .01							T	Ī	1	0		7	_ C
M		M		X			X	1		Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01							T	Ī	1	1		2	Ê
M		X		X			X			Depth to water table from top of casing prior to sampling with cap off	feet: to nearest .01	Ę	3	2	5	4	6				1		6	3
M		X		X			X			Depth to water table from original ground level prior to sampling	feet: to nearest .01	ŀ	,	2	0	1	9				2		1	3
		X					<u>i</u>			Arsenic, Dissalved	UG/L as As	c	)	1	0	la	0		Π			$\prod$	$\overline{}$	_
			T	Ī						Barium, Dissolved	UG/L as Ba	C	<u>,                                    </u>	1	0	10	5		ļ		Π	Ī	1	_
			T	Τ	Π	İ				Biochemical Oxygen Demand - 5 Day	MG/L	O	I	0	3	ı	0	Π	Ī		Π	T	T	_
	11	T	1	1						Cadmium, Dissolved	UG/L as Cd	0	ij	1	0	2	5	Π	Π		П	Ī	1	
X		XI	Ī	IX			X			Chlaride, Dissalved	UG/L as CI	8	I	2	2	9	5			3	7	7 (	<u> </u>	οĪ
	$\overline{ }$	1	T			П				Chromium, Dissolved	UG/L as Cr	0	Ī	1	0	3	0					T	1	-
$\Pi$	1	T	T	T			ĺ			Chromium, Dissolved, Hexavalent	UG/L as Cr	0	1	1	2	2	a	П	,		T	$\top$	T	7
	11	T	Ī.	T		1		-	•	Chemical Oxygen Demand (COO), Dissolved	MG/L	0	10	ן כ	3	4	1			-	T	T	1	7
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							Ī			Gross Alona, Dissolved	Pc/L	0	1	I	5	0	3			Ī	Ī	Ī		Ĺ
		1	Γ		1	Ī	1	T	Ī	Gross Beta, Dimotved	Pc/L	0	3	Ī	5	a i	3	1		1	1	1		
		1		11	1	Ī	T	T	T	Hardness, Total as CaCO <sub>3</sub>	MG/L	0	0	1	9	0	0		T	1	Ī	1	1	$  \downarrow  $
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## GROUND WATER ANALYSIS - MONITORING WELL REPORT

FACILITY NAME	Unocal Chemi	cals - Carteret, NJ		SW IO NO.	
LAB NAMÉ		atories, Wappingers. Fa	lls NY	<u>MW-11</u>	· · · · · · · · · · · · · · · · · · ·
	NIPOES NO.	WELL PERMIT NO.	SAMPLE DATE		
S NJ	0 0 2 6 0 7 7	2 6 - 0 8 5 6 2 - 3	8 9 02 06	7 3 4 6 0	MOM USE

THE SCHEDULE INDICATED BELOW IS TO SE OBSERVED FROM DE 18 8 TO

## SUBMIT WITH SIGNED T. VWX-014

												SUBMIT WITH SIGNED TOWN	-014														u
		\$	اسد	P L 11	NG	M	3N	TH:	S																		REMANKS
. 복	F.	Mei.	Apr.	May	Jun.	À	Aug.	2	Del.	2	D.	ANALYSIS	UNITS	,	PA	A A	M	€T	ER			\	/AL	.UE			10.611
										1		Methoxychior, Total	UG/L	[3	1	9	4	8	0	I	Ī	Ī		Ī			Ĺ
				-						L		Methylene Blue Active Substances	MG/L	3		3	2	ő	0		Ī						L
									_			Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	0	1	2	5	0	! 8	L							Ĺ
												Nitrogen, Nitrate Dissolved	MG/L as N	0	10	)	6	1	18								ĺ
			1	1		_ [						Odor	T.O.N.	0	10	)	0	8	5		Ĺ		1				
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					-							Phenois, Total Recoverable	UG/L	3	12	!	7	3	10		!	i		!			
	1			Ī	1	Ī	ļ					Radium 225, Dissolved	PeiL	0	9	١Ī	5	0	3		Π	Ī					
			ŀ		Ī	Ī	-					Radium 229, Dissolved	Pe/L	8	1	Ţ	3	6	6		1	1_			ı		
	- 1		Ī		T	-		-				Selenium, Dissalved	UG/L	0	1	1	1	4	5		Ī				İ		
	T			1					-			Silver, Dissolved	UG/L	0	įı	1	o	7	5		!	Ī			1		
		-	Ī		-	Ī	Ī	-				Sadium, Dissalved	MG/L	0	0	İ	9	3	a						- 1		
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# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION OF WATER RESOURCES

## WATER CUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE TYP	e cr print with Ballpoin	it ien			
FACILITY N	AME UnocalChemic	al _ Carteret, NJ		5.0 10 NO MW-11	
LAB NAME	NANCO Labor	atories- Wappinger Fal	ls. NY		
	nipoes no.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	. الـ لــــــ 8 CERT, NO.	22U MDW
Ţ	NJ dds dd 71 7	26-08562-3	8 9 0 2 0 6	रीय विषे	

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0. YR. TO 0 8 9 12 !

## SUBMIT WITH SIGNED T-VWX-014

## SAMPLING MONTHS

Jan. Mar. May. Juny Auly Sapt. Oct.	ANALYSIS	עוואט	PARAMETER	VALUE
MIMIMIM	Acrylonitrile	UG/L	3 4 2 1 5	1
	Benzene	UG/L	3 4 10 13 10	1 .  0   H
	Bromotorm	UG/L	3 2 1 1 0 4	1  -  0   H
	Carbon Tetrachtoride	UG/L	3 2 1 0 2	
	Chloropenzene	UG/L	3 4 3 0 1	.     1   .   4
	Chlorodibromœthane	UG/L	3 4 3 0:6	1 . 0   F
	Chloroform	UG/L	3 2 1 1 0 6	1 . 0 F
	1, 1 - Dichtoroethane	UG/L	314141916	1 .i0  F
	1, 2 - Dichtoroethane	UG/L	3 4 15 13 1	11.10 F
	1. 1 - Dichlargethylene	UG/L	3 4 5 0 1	
	1. 2 · Dichloropropane	UG/L	3 4 5 4 1	1 . 0  K
	Emylbenzene	UG/L	314 317 1	1   0   K
	Methylene Chloride	UG/L	3 4 4 2 3	1 . 0  F
	1, 1, 2, 2 - Tetrachtoroemane	UG/L	3 4 5 1 - 6	i i i i i i i i i i i i i i i K
	Tetrachigroethylene	UG/L	3 4 4 7 7 5	i         1   0   K
	Taluene	UG/L	3 4 0 1 2	1 i. 0 K
	1, 1, 1 - Trichloroethane	UG/L	314151015	! !   11 . O K
	1, 1, 2 - Trichlorgethane	UG/L	314151111	1   .   0 K
	Trichloroethylene	UG/L	3 9 1 8:0	
11 1 11 1 1 1 1 1 1 1 1 1	Vinyl Chloride	UG/L	3 9 11 7 5	11.10 K
11 1 11: 1 11: 1 11: 1	Acrolein	UG/L	3141211 0	2.5 K
11 4 11!	Chloroethane	UG/L	3(4)3:1,1	1 1 0 K
	2 - Chlaroemylvinyl Etter	UG/L	3:415:7.6	i i    1i.  0 K
If I ris I III i I.I i	Dichtorobromomethane	UG/L	3 2 1 0 5	: : : 11.10K
11 1 11 1 11 1 11 1 1	1, 3 · Dicataraaraayiene	UG/L	314 6!9:9	1   . ! 0   K
11   1   1   1   1   1   1   1	Methyl Bramide	UG/L	3 4 4 1 1 1 3	1 ! ! 11. OK
11 1 11: 1 111 1 11: 1 1	Metnyl Chlaride	UG/L	314141118	! ! 111. 0 K.
11 1 11: 1 111 / 111 4 1	1, 2 - trans - Dichlorgethylene	UG/L	314:5:4:5	11. 0 K
11 1 11: 1 111 : 111 1	1, 2 Dichlorobenzene	UG/L	314151315	: :   11. 0 K
11 1 1 1 1 1 1 1 1 1 1 1 1	1, 3 Dichloropenzene	UG/L	31415; 5. 5	
	1, 4 Dichtargaenzene	UG/L	31415171	
VALUE CODING RULES AND REMARK CODES ON REVERSE			29 13 14 42 46 47 33 39 40 44 72 73	40 4: 31 5+ 54 4- 77 40

Form YMX-017 USD P1

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

FACILITY	PE OR PRINT WITH BALLPOINT	1 Chemical - Carteret,	NJ	54 10 40. MW-1	1
LAS HAME	- NANCO Labora	tories - Wappingers Fa	ills NY		
Ō	NJO 0 2 6 0 7 7	26-08562-3	890206	MI LAB CERT. MO.	MCM (ZE

THE ECHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 1018 818 TO 118 1012

•	SUBHIT WITH SIGNED T-PWE	T-014	<b>:</b>	_
SAMPLING MONTHS	•			ž Š
444444444	ANALYEE	UHITS .	PARAMETER	ANTRE #
	2-Chlorophenol	ug/l	3 4 5 8 6	
	2,4-Dichlorophenol	ug/l	34601	
	2,4-Dimethylphenol .	ug/1	34606	
	2,6-Dinitro-o-cresol	ug/1	77603	
	2,4-Dimitrophenol	ug/1	3 4 6 1 6	
	2-Mitrophenol	ug/l	3 4 5 9 1	
	4-Nitrophenol	ug/I··	3 4 6 4 9	
	p-Chloro-a-cresol	ug/l	3 4 4 5 2	11111
	Pentachlorophenol '	ug/l	3 9 0 3 2	1 1 1 1 1 1 1
	Phenol	ug/1	3 4 6 9 5	
	2,4,6-Trichlorophenol	ug/1	3 4 6 2 1	11111
	•		1111	
	Acenahahana	112/1	3/4/2/0/5	
	Acenaphthylene	ug/1	314/2/0/0	
	Anthracene	ug/1	3 4 2 2 0	•
	Benzidine	ug/l	3 9 1 2 0	
	Benzanthracene	ug/1	3 4 5 2 6	
	Benzopyrene	ug/1	3 4 2 4 7	
	3,4-Benzofluoranthene	ug/1	3 4 2 3 0	
	Benzoperylene	ug/l	3 4 5 2 1	
	Benzofluoranthene	ug/l	3 4 2 4 2	<u> </u>
	Bis(2-chloroethoxy)methane	ug/l	3 4 2 7 8	
	Bis(2-chloroethyl) Ether	ug/l	3 4 2 7 3	
7	Bis(2-chlroisopropyl) Ether	ug/l	3 4 2 8 3	
	Bis(2-ethylhexyl) Phthalata	ug/l	3 9 1 0 0 1	11111
	4-Bromophenyl Ether	ug/l.	3 4 6 3 6	
	Butylbenzyl Phthalata	_ug/l	3 4 2 9 2	
	2-Chinychenhshalene	uz/1	3/4/5/8/1	<del></del>
	4-Chinenphenyl Phenyl Ether	ug/1	3141614111	111111

VALUE COOING RULES AND

Fem YWX-017 4/83 P2

# HEW JETROPO TO THE WITH A TO THE WITH A TO THE CONTROL OF THE PROPERTY AND

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

P	L <i>Ease</i>	TYPE	0.	PRINT	mith 8	るししゃ	DINT PEN	

FACILITY NA	Unocal Che	micals - Carteret, NJ		SW 10 NO. MW-11	
LAC AME	NANCO Labo	ratories - Wappingers f	alls NY		
	ALPDES NO.	WELL PERMIT NO.	SAMPLE DATE . TR.   MO.   DAT	NJ LAB CERT. NO.	#CM (42 E
Î Î	14493490FM	26-08562-3	8 9 0 2 0 6	द्वीउपिहारी	

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 018 818 TO 08 9 12

### SUBMIT WITH SIGNED T. FWX-014

SAMPLING MONTHS			•	
1111111111	ARALYES	UHITE	PARAMETER	VALUE \$
	Chrysene	ug/1	3 4 3 2 0	TITT
	Dibenzanthracene	ug/1	3 4 5 5 6	
	1,2-Dichlorobenzene	ug/1	34536	
	1,3-Dichlorobenzene	ug/l	3 4 5 6 6	
	1,4-Dichlorobenzene	ug/l	3 4 5 7 1	
	3.3'-Dichlorobenzidine	ug/l	3 4 6 3 1	
	Diethyl Phthalate	ug/1	3 4 3 3 6	<del>                                      </del>
	Dimethyl Phthalate	ug/1	3 4 3 4 1	
	Di-n-butyl Phthalate	ug/1	39110	
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1	
	2,6-Dinitrotolulene	ug/1	3 4 6 2 6	
	Di-m-octyl Phthalate	ug/1	3 4 5 9 6	11111
	1.2-Diphenylhydrazine	ug/1	3 4 3 4 6	
	Fluoranthene	ug/1	34376	
	Fluorene	ug/1	3 4 3 8 1	
	Bexachlorobenzene	ug/1	397001	
	Hexachlorobutadiene	ug/l	3 4 3 9 1	
	Bexachlorocyclopentadiene	ug/1	3 4 3 8 6 1	
	Hexachloroethane	ug/l	3 4 3 9 6 1	
	Indenopyrene	ug/l	344031	
	Isophorope	ug/l	34408	
	Maphthalene	uz/1	34696	
	Mizzabenzene	uz/1	34447	
	H-Mistagndinenslyamine	uz/1	3443811	
	N-Nitrosodi-n-propylamine	ug/1	3 4 4 2 8 1 1	
	N-Nitrosodiphenylamine	ug/l	3 4 4 3 3 . 1	
	Phenanthrene	· ug/l	344611	TILLI
	Pyrene	ug/1	3 4 4 6 9 1	
	1,2,4-Trichlorobenzene	ug/1	D 4 5 5 1 1 1	

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL FEO POSTECTION OF WATER RESOURCES THE MAIST THE MANAGEMENT STEEMENT.

WILL GOLDT MANAGEMENT	Cawes 1	
GROUND WATER ANALYSIS - MONITO	RING WELL REPORT	
PLEASE TYPE OR PRINT WITH BALLADINT PEN		
FACILITY NAME Unocal Chemicals - Carteret, NJ	SW 10 40 MW-11	
NANCO Laboratories - Wappingers Fal		
Sampl	EDATE	
	O.   DAY NJ LAB CERT. NO.	WCM USE
NJO 0 2 6 0 7 7 2 6 0 8 5 6 2 - 3 819 10	206 7 4 4 4 9	
	•	
THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 018 818 TO NO. YR.	01 8 91 2 xx.	
SUBMIT WITH SIGNED T. VWX	-014	
Sampling months	<del></del>	×
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X X X X Floating Product	inches	11110
X X X X Total Xvlenes	ug/1	1 . 0 K
		11111
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	Floating Product	inches			T	I	T	T	7	T	1	-		T	Ī	(
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PINDION OF WATER REPUBLICES

## MONITORING REPORT - TRANSMITTAL SHEET

NUPDES NO.

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REPORTING PERIOD .

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111818 THE [011819]

PERMITTEE:	Mnocal Chemical							
	Address 1345 North Meacham	Road						
	Schaumburg. IL	60196						
FACILITY:	Name Unocal Chemicals Div	vision						
	Address 350 Roosevelt Avenue	)	·					
	Carteret	(County) Middlesex						
	Telephone <u>( 201 ) 541- 4224</u>							
FORMS ATTACH	ED (Indicate Quantity of Each)	OPERATING EXCEPTIONS						
SLUDGE REPORTS	- SANITARY		YES	NO				
T-VWX-007	E00-XWV-T B00-XWV-T	DYETESTORG		$\nabla$				
SLUDGE REPORTS	INOUSTRIAL	TEMPORARY BYPASSING						
T-VWX-010	AT.VWX-0108	DISINFELTION INTERRUPTION		<b>X</b>				
WASTEWATER REP	ORTS	MONTTORES MALFUNCTIONS		<u> </u>				
T-VWX-011	T-VWX-012 T-VWX-013	UNITS OUT OF OPERATION OTHER		<b>&amp;</b>				
GROUNOWATER RE	B) 1 VWX-016 1 VWX-017	(Descrit sary "Yes" on reverse side in appropriate space.)						
NPDES DISCHARGE	монітоянь я <del>єр</del> оят 3320-1	NOTE: The "Hows Attended at Place reverse of this sheet must also be con		te				
AUTHENTICATIO	information submitted in this doc of those individuals immediately a submitted information is true, acc	t I have personally examined and am fail tument and all attachments and that, ba responsible for obtaining the informatio turate and complete. I am aware that the rmation including the possibility of fine	ised on a an, I bel sere are	my inc ieve th signifi				
LICENSED OPERA	тоя	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE						
Name (Printed)		Name (Process) Daryl W. Dierwecht Supervisor Environ	er	<del></del>				
Grade & Registry No		Supervisor Environmental Title (Prince) Affairs						
Signature		Signature Day 10 Diene	ette					
Date		Date						

PERATI	NG EXCEPTIONS DETAILE	D																
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Others																
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Licensed Operator																
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## M JERSEY JERARTMENT OF ENVIRONMENTAL PROTECTION CEDANGE TO MOISIVIO

## WATER QUALITY MANAGEMENT ELEMENT

### GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

PLEASE TYPE OR PRINT WITH BALLPOINT JEN

FACILITY	unocal Chem	tal Carteret N.1		SW 10 40   MW-12	
LAB NAME		s. Wanningers Falls	NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT. NO.	WOM USE
R	rkbakbbru	2 6 - 0 8 5 6 3 - 1	8 9 0 2 0 6	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO 35 OBSERVED FROM OF RIA TO HO. YE.

## SUBMIT WITH SIGNED T-VWX-014

Sampling months				
Feb. Mary Mary Aug Sojit.	MALYSIS	ZTINU	PARAMETER	VALUE
MIMIMIMI	Elevation of top of well casing with cap off (as medified in well completion report)	feet MSL: to nearest .01		12.10
MIMIMIMI	Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01		12.48
MININIMI	Depth to water table from too of casing prior to sampling with cap off	feet: to nearest 01	8 2 5 4 6	2.16
MINININI	Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	2.54
	Arsenic, Dissolved	UG/L as As	01: 0000	
	Barium, Dissolved	UG/L as 3a	0 1 0 0 5	11111
	Biochemical Oxygen Demand - 5 Day	MG/L	0 0 3 1 0	
	Cadmium, Dissolved	UG/L as Cd	0 1 0 2 5	1 1 1 1 1 1
XIXIXIXI	Chloride, Dissalved	UG/L as CI	8 2 2 9 5	8   7   4   0
	Chramium, Dissalved	UG/L as Cr	011030	11111
	Chromium, Dissolved, Hexavalent	US/Las Cr	0 1 2 2 0	111111
	Chemical Oxygen Demand (COO), Dissolved	MG/L	0 0 3 4 1	
	Caliform Group	N/100 ML	7 4 0 5 6	
	Calar	Pt · Co	ololololo	11111
	Capper, Dissolved	UG/L as Cu	0 1 0 4 0	
	Cyanide, Total	MG/L as CN	0 0 7 2 0	
	Endrin, Total	UG/L	3 9 3 9 0	11111
	Fluoride, Dissolved	MG/L as =	0 0 9 5 0	111111
	Gross Alona, Dissolved	Ps/L	0 1 1 5 10 3	
	Gross Beta, Dissolved	Pe/L	0 3 5 0 3	
	Hardness, Total as CaCO <sub>3</sub>	MG/L C	0 0 0 9 9 0 0	
	Iran, Dissalved	UG/L as =e	0 1 0 4 5	
	Lead, Dissolved	UG/L as 25 (	0 1 0 4 3	
	Lindane, Total	UG/L	3 9 7   8   2	11111
	Manganese, Dissolved	UG/L G	1 0 5 5	
- I X I I I I I I	Mercury, Dissaired	UG/L 7	ole's irly	11111
VALUE CODING RULES AND REMARK CODES ON REVERSE		29 47 55 68	2 46 47 3 59 50	53 34 66 4

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

	OR PRINT WITH BALLPOIN	TPEN			
FACILITY NA	Me Unocal Chemi	cals - Carteret, NJ		SW 10 NO.	
LAS NAME		atories, Wappingers Fa	ılls. NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT, NO.	WOM USE
S	N-0 0 2 6 0 7 7	26-018151613-11	8 9 0 2 0 5	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0. 18 TO 08 9 12 70. YR.

## SUBMIT WITH SIGNED T.VWX-014

UG/L MG/L as N MG/L as N T.O.N. Standard Units UG/L	0 0 0	0 0	6	5	9			1				
MG/L as N MG/L as N T.O.N. Standard Units	0	0	6	0	8		1					
MG/L as N T.O.N. Standard Units	0	o   o	6		_							_
T.O.N. Standard Units	0	٥		1	ß	+	Ť	-		_		í
tandard Units		_				1	1	1				$\overline{}$
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UG/L	3   9	)   4	4 ! (	<b>3</b>	0	i	1	$\exists$	Ī	1	i	_
NTU	lolo	1   0	j :	7 !	5		i	-	Ī	T	į	
UG/L	0 1		) : (	3 ;	٥١	+	Ĩ	j	1	1	:	
UG/L	313	113	1 : 7	7!	a l	!	1	-	1	1	1	
UG/L	3   9	10	د ( ر	1	5	1	1		T	1	1	_
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	$\sqcap$	T	i	1	T	1	T	T	j	T	-	
i	$\sqcap$	1	!	Ī	T	;	I	1	1		:	
	1	!	1	1	1	1	-	1	ī	1	İ	1
		:	;	!	Ť		!	1	!	!	;	
	Ī	Ī	į	1	Ť	i	İ	i	1	ī	;	1
	Pe/L UG/L UG/L MG/L MG/L PPM PPM UG/L UG/L UG/L UG/L UG/L UG/L	Pe/L         8           UG/L         0           UG/L         0           MG/L         0           MG/L         0           MG/L         0           PPM         7           PPM         0           UG/L         7           NTU         0           UG/L         0           UG/L         0           UG/L         3           UG/L         3           UG/L         3	P=/L 8 1   UG/L 0 1   UG/L 0 1   UG/L 0 0 0   UG/L 0 0 0   UG/L 7 0   UG/L 7 0   UG/L 3 9   UG/L 3   9   UG/L 3   9   UG/L 3   9   UG/L 3   9   UG/L 1   UG/L 3   9   UG/L 1	P=/L	P=/L	P=/L	P=/L	P=/L	P=/L	P=/L	P=/L	P=/L

narm + /1 572 3 4/83

## NEW JETTSET DETAIL MENT OF ENVIRONMENTAL THOTECT.ON DIVISION OF WATER RESOURCES

## WATER CUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PL	EASE	rype	QR	PRINT WIT	H BAL	LPOINT PEN
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LEEWIG /	( UM	• • • • • • • • • • • • • • • • • • • •			
FACILITY NA	unocalChemic	al _ Carteret, NJ		5 v 10 na MW-12	
LAB NAMÉ	NANCO Labor	atories- Wappinger Fa	lls. NY		
	NIPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LA LAB CERT, NO.	WCM USE
Ţ	My d d s e d y y	3 8 - 9 8 4 9 1	8 9 0 2 0 6	र्वे अव ष्वे	

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0 8 8 8 TO 0 18 9 12 1

## SUBMIT WITH SIGNED T-VWX-014

Feb. Mar. Apr. Auns Sapr. Oce.	ANALYSIS	UNITS	PARAMETER	VALUE
ININIX	Acrylonitrile	UG/L	3 4 2 1 5	
	Benzene	UG/L	34101310	1   . 10
	Bromoform	UG/L	3 2 1 1 0 4	1 .  0
	Carbon Tetrachloride	UG/L	3 2 1 0 2	
	Chiaragentene	UG/L	3 4 3 0 1	1   .   0
	Chlorodibromoethane	UG/L	3 4 3 0'6	1 . 0
	Chloroform	UG/L	3 2 1 1 0 6	1 .  0
1 111 1 111 1 111	1, 1 - Dichtgroethane	UG/L	3 4 4 9 6	1 .  0
1:11 1:11:1:11	1, 2 - Dichtgroethane	UG/L	3 4'5!3'1	:    1 .10
1 111 1 111 1 11!	1, 1 - Oichlaroethylene	UG/L	34501	1  -   0
111111111	1, 2 - Oichlorogragane	UG/L	3 4 5 4 1	1 . 0
1 1 1 1 1 1 1 1-11	Ethylbenzene	UG/L	314 317 1	1   1   2   4
	Methylene Chloride	UG/L	3 4 4 2 3	111110
1 11 1 1 1 1 1 1 1 1 1 1	1, 1, 2, 2 - Tetrachiorpethane	UG/L	3 4 5 1 - 5	1   111.10
1111111111	Tetrachloroethylene	UG/L	3 4 4 7 5 1	!     1  . 0
1 111 1 111 1 111	Taluene	UG/L	3 4 0 1 2 .	: 110
1:1: 1 11: 1 111	1, 1, 1 - Trichloroethane	UG/L	31415:015	11.0
1 111 1 111 1 111	1, 1, 2 - Trichloroethane	UG/L	314/5/1/11	i i i i i i l. i O
1 11 1 1 1 1 1 1 1 1 1	Trichlaroethylene	UG/L	3 9 1 3:0	1   11:10
	Vinyl Chloride	UG/L	3 9 1 1 7 5	1 11.0
	Acrolein	UG,'L	31412110	2:5
	Chigroethane	UG/L	3141311.1	1, 0
1 11 1 1 1 1 1 1 1 1 1	Z - Chloroethylvinyl Ether	UG/L	3 4 5 7 6	, , 11 0
1 ::: 1   1   1   1	Dichlarabromamethane	UG/L	3 2 1 . 3 . 5	1 1 10
1 111 1 111 1 111	1, 3 - Oichtaragrapytene	UG/L	314(6:9/9 :	:     1  .! 0
	Methyl Bramide	UG/L	3 4 4 1 1 : 3 :	1 : 11 . 0
	Methyl Chlorice	UG/L	31414.118	11.0
	1, 2 - trans - Dichtgraethylene	UG/L	314:5:4.5	1 . 0
	1, 2 Dichtgrapenzene	UG/L	31415.315	:   1 . 0
	1.3 Dichtoropenzene	UG/L	3141515-5	11.01
	1, 4 Dichtorgenzene	UGIL	214:5,7:1	:1'. 0 1
ALUE CODING RULES A EMARK CODES ON REV	0		29 JJ 14 42 46 47 13 59 40 64 72 1	40 91 53

Ferm VWX-017 UK3 P1

VALUE COOME RULES AND

### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

GROUND WATER	ANALTSIS - MOR	ALIONING	AEEE MELONI
ACID,	BASE/NEUTRAL	ORGANIC	COMPOUNDS

FACILITY M	E OR PRINT WITH BALLPOIN	il Chemical - Carteret,	NJ	5W 10 NO. MW-12	
LAS HAME	· NANCO Labora	tories - Wappingers Fa	lls NY		
Ō	NJPDES MO. NJO 0 2 6 0 7 7	26-08563-1	890206	ZIZARD	MCM CZE

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 10 18 18 TO 1018 Q Z

		SUBHIT WITH SIGNED T-YW	<u>r-014</u>	:	_
	SAMPLING MONTHS -	•			**
	11111111111	ANALYEE	UNITS .	PARAMETER	AVTAE 3
	TINITI XI	2-Chlorophenol			
			ug/l		
		2,4-Dimethylphenol .	ug/l		
		2,6-Dimitro-o-cresol	ug/1 ·		
		2,4-Dinitrophenol	ug/1		
		2-Nitrophenol			
		4-Nitrophenol	ug/I···		
		p-Chloro-m-cresol	ug/1		11111
Phenol		Pentachlorophenol '	ug/1	3 9 0 3 2	11111
			ug/1	3 4 6 9 5	1
		2.4.6-Trichlorophenol	ug/1	3 4 6 2 1	1 1 1 1 1 1
Acenaphthylene		•		1111	
		Acanahahana	uz/1		
Anthracene		Acenaphthylene	ug/l	3 4 2 0 0	<u> </u>
			ug/l	3 4 2 2 0	1 1 1 1 1 1
Benzopyrene		Benzidine	ug/1		1 1 1 1 1 1 1
3,4-Benzofluoranthene   ug/1   3 4 2 3 0		Benzanthracene	ug/1		
		Benzopyreae	ug/1	3 4 2 4 7	
		3,4-Benzofluoranthene	ug/1	3 4 2 3 3 0	
Bis(2-chloroethoxy)=ethane		Benzaperylene	uz/1		
Bis(2-chloroethoxy)=ethane   ug/l   3   4   2   7   8		Benzofluoranthene	ug/l	3 4 2 4 2	
Bis(2-chloroethyl) Ether   ug/1   3 4 2 7 3			ug/l		
Bis(2-chlroisopropyl) Ether   ug/l   3 4 2 8 3			ug/l	3 4 2 7 3	<u> </u>
			ug/l	3 4 2 8 3	
4-Bromophenyl Ether ug/1. 3 4 6 3 6			ug/l	3 9 1 1 0 0	
Butvlbenzyl Phthalate			ug/l.	3 4 6 3 6	
2-Chlorchenhalene uz/1   3   4   5   2   1			ug/1	3 4 2 9 2	<u>-                                    </u>
			uz/1		
4-Chioranhenyl Phenyl Ether ug/1 121-101-11 40 41		4-Chiorophenyl Phenyl Ether	ug/l	3 4 6 4 1 1	40 11

Fem YWX-017 4/83 P2

VALUE CODING RULES AND REMARK CODES ON REVERSE

# POTECT OF ENVIRONMENTAL PROTECT OF ENVIRONMENTAL PROTECT OF MAINTAINERS RESEARCH THEMENT STAM TILAUD RETAW

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

7	Z A	151	•	TYPE	0.	PRINT MIT	'N BALLPOINT PEN	
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FACILITY HAS	Unocal Chem	icals - Carteret, NJ		SW 10 40. MW-12	
LAC AME	NANCO Labor	atories - Wappingers	Falls, NY		
	NUPOES NO.	WELL PERMIT NO.	TE.   MO.   BATE .	NU LAB CERT, NO.	#CH UKE
א ֿעַ	10026077	26-08563-1	890206	73460	

THE SCHEDULE MOICATED BELOW IS TO BE OBSERVED FROM \$18 818 0 TE MA TE.

## SUBMIT WITH SIGNED T-FWX-014

SAMPLING MONTHS				3
11111111111	AMALYES .	UHITS	PARAMETER	AVTRE
	Chrysene	ug/1	34320	
	Dibenzanthracene	ug/1	34556	
	1,2-Dichlorobenzene	ug/1	3 4 5 3 6	1-1
	1,3-Dichlorobenzene	ug/1	3 4 5 6 6	
	1,4-Dichlorobenzene	ug/l	3 4 5 7 1	
	3,3'-Dichlorobenzidine	ug/1	3 4 6 3 1	
	Diethyl Phthalate	ug/1	3 4 3 3 6	
	Dimethyl Phthalate	ug/l	3 4 3 4 1	
	Di-n-butyl Phthalate	ug/1	39110	
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1	
	2,6-Dinitrotolulene	ug/l	3 4 6 2 6	
	Di-m-octyl Phthalate	ug/l	3 4 5 9 6	
	1,2-Diphenylhydrazine	ug/1	3 4 3 4 6	
	Fluoranthene	ug/1	3 4 3 7 6 1	
	Fluorene	ug/1	3 4 3 8 1	
	Hexachlorobenzene	ug/1	39700	
	Hexachlorobutadiene	ug/1	3 4 3 9 1	
	Hexachlorocyclopentadiene	ug/1	3 4 3 8 6	
	Rexachloroethane	ug/1	3 4 3 9 6 1	
	Indenopyrene	ug/1	344031	
	Isophorone	ug/l	344081	
	Machthalene	uz/1	3 4 6 9 6	
	Misrobenzene	uz/1	34447	
	H-Wissandinenslyamine	uz/1	3 4 4 3 8	
	N-Nitrosodi-n-propylamine	ug/l	3 4 4 2 8	
	N-Nitrosodiphenylamine	ug/1	3 4 4 3 3 .	
	Phenanthrene	· uz/1	3 4 4 6 1 1	
	Рутеле	ug/l	13 4 4 6 9 1 1	
	1.2.4-Trichlorobenzene	uz/l	B 4 5 5 1 1	
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# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

4/83	DIZER RETAW RD NOICIVIO BARDANAM YTIJAUD RETAW			
	GROUND WATER ANALYSIS - MONI		REPORT	
PLEASE TYPE OF PRINT WITH 3	ALL20INT 25N			
FACILITY NAME	Inocal Chemicals - Carteret, NJ		24 10 40 MW-	12
LYS NAME			114-	72
	MANCO Laboratories - Wappingers F	MPLE DATE	<del></del>	
ON 2309LM	WELL PERMIT NO. YR.	1 MO. 1 OAY	NJ LAB CERT. NO.	WCM USE
U NJO 0 2 6 0	7   7   2   6   -0   8   5   6   3   -1   8   9	0 2 0 6	भे य व व पं	
•	• 7 16 17	22	21 - 27	73
THE SCHEDULE INDICATED SE	LOW IS TO SE OBSERVED FROM 018 818 T	018 912 MO. YR.		
	SUBMIT WITH SIGNED T-V	TW.X-014		
Sampling months				
Jan. Fab. Mer. July Aug. Sapi.	ANALYSIS	ZTINU	PARAMETER	VALUE
	Specific Conductance	mhos/cm		2   6   3
x	Floating Product	inches		0
X   X   X   X	Total Xvlenes	ug/l		1 .  O   I
				11111
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			11111	

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## MONITORING REPORT - TRANSMITTAL SHEET

NIPOES NO.

REPORTING PERIOD .

MO. TR.

0101216101717

Mnocal Chemical

1,18,8 THE [0,118,9]

PERMITTEE:	Name		· · · · · · · · · · · · · · · · · · ·		
	Address 1345 North Meacham	Road			
	Schaumburg, IL	60196			
FACILITY:	Name Unocal Chemicals Di	vision			
	Address350 Roosevelt Avenu	ie			
	Carteret	(Coun	Middlesex		
	Telephane <u>( 201 ) 541- 4224</u>				
FORMS ATTACH	ED (Indicate Quantity of Each)	OPE	RATISS EXCEPTIONS		
SLUDGE REPORTS	- SANITARY			YES	NO
T-VWX-007	ECO-XWV-T BOO-XWV-T	DYE	TESTONS		$\nabla$
SLUDGE REPORTS	· INOUSTRIAL	Tex	PORARY BYPASSING		
T.VWX-010	A T.VWX-010B	DIST	FECTION INTERRUPTION		<b>&amp;</b>
WASTEWATER REP		i	TORANG MALFUNCTIONS		<u> </u>
T.VWX-011	T-VWX-012T-VWX-013	ингт. ОТНЕ	ecut of Operation		<b>X</b> C
GROUNDWATER RE	9) 1 VWX-016 1 VWX-017		il essy "Yes" on reverse side <del>propriese</del> spece.)		
NPDES DISCHARGE	монітоя інд я <i>ер</i> оят 3320-1		: The "Hows Attended at Pla e of this sheet must also be co		te
AUTHENTICATIO	<ul> <li>N - I certify under penalty of law the information submitted in this do of those individuals immediately submitted information is true, acceptables for submitting false information.</li> </ul>	cument and a responsible for curate and co	9 attachments and that, b or obtaining the informatio mpieta. I am aware that t	ased on a on, I bel here are	my inc ieve th signifi
LICENSED OPERA	TOR		EXECUTIVE OFFICER or CRIZED REPRESENTATIVE	ŧ	
Name (Printed)		Name (Prices)	Daryl W. Dierwecht	ær	
<b>6</b>		,	Supervisor Enviror	mental	•
urabe or negistry No		Title (Printed)	Arrairs (/// )	4	<del></del>
Signature		Signature	May 11 Nilin	200	
Date		Dete	March 21, 1989		

OPERATING EXCEPTIONS DETAILED	<u> </u>																			
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Day of Month	1	2	3	4	5	6	7	8	9	10	111	1:	2   1	3	14	15	116	5		
Licensed Operator					<u> </u>				_		$\vdash$	<u> </u>	+	<u> </u>		<u> </u>	<u> </u>	-		
Others  Day of Month	17	10	10	20	21	22	77	74	75	75	1 27	70	<u> </u>	-	70	7.	<u> </u>	-		
Licensed Operator	''	, 6	13	40	41	44	4-3	47	43	43	47	1 25	1	1	30	31	$\frac{\vdash}{\vdash}$	-		

Others

## W. JERSEY DEPARTMENT OF TRUNCHIAL PROTECTION OF WATER RESURCES

## WATER QUALITY MANAGEMENT ELEMENT

## GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

21	EACE	TYPE	20	BRINTY	UTH GAI	I POIN"	ieu

FACILITY N.	unocal Chemi	tal Carteret N.1		SW 10 NO MW-13	
CAB NAME		s. Wappingers Falls,	ΛĀ		
	nipoes no.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	NJ LAB CERT, NO.	WOM USE
R	undqqqqqqq	26-09350-2	8 9 0 2 0 6	7 3 4 6 0	

THE SCHEDULE INDICATED BELOW IS TO 35 OBSERVED FROM 10 8 8 8 TO 18 912

## SUBMIT WITH SIGNED T-VWX-014

SAMPLING MONTHS				
Jan. Fati. Mor. Apr. Aug. Sept.	ANALYSIS	UNITS	PARAMETER	VALUE
MINIMIMI	Elevation of top of well casing with cap off (as specified in well completion report)	feet MSL: to nearest .01		111.74
MINIMIM	Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01		1 2 . 3 0
MINIMIMI	Depth to water table from top of casing prior to sampling with cap off	feet: to nearest 01	8 2 5 4 6	2.16
MIMIMIM	Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	2 .   7   2
	Arsenic, Dissalved	UG/L as As	0110000	
	Barium, Dissolved	UG/L as 3a	0 1 0 0 5	1 1 1 1 1
	Biochemical Oxygen Demand - 5 Day	MG/L	0 0 3 1 1 0	
	Cadmium, Dissolved	UG/L as Cd	0 1 0 2 5	
X I X I X I X I	Chloride, Dissalved	UG/L as CI	8 2 2 9 5	1 7 8 0 0
	Chramium, Dissalved	UG/L as Cr	0 1 0 3 0	
	Chromium, Dissolved, Hexavalent	شکار۲۶۶ ۵۰	0 1 2 2 0	
	Chemical Oxygen Demand (COD), Dissolved	MG/L	0 0 3 4 1	
	Caliform Graup	N/100 ML	7 4 0 5 6	
	Calar	Pt - Ca	0 0 0 0 18 10	
	Capper, Dissalved	UG/L as Cu	0 1 0 4 0	
	Cyanide, Total	MG/L as CN	0 0 7 2 0	
	Endrin, Total	UG/L	3 9 3 9 0	
	Fluoride, Dissalved	MG/L as =	alalais!al	
	Grass Alona, Dissalved	Pc/L	0 1 5 0 3	
	Gross Beta, Dimolved	Pc/L	0 3 5 0 3	
	Hardness, Total as CaCO <sub>3</sub>	MG/L	0 0 0 9 0 0 0	
	Iran, Dissalved	UG/L as =:	0 1 0 4 5	
	Lead, Dissolved	UG/L 45 25	0 1 0 4 3	
	Lindane, Total	UG/L	3 9 7   8   2	
	Manganese, Dissalved	UG/L	0 1 0 5 5	
	Mercury, Dissalved	UG/L	7 1 8 9 5	
			9 13 2	40 4.

## NOITDETORS JATHEMHORIVHE TO THEMTRACED YESFEL WEN NOITDETORED RESOURCES WATER QUALITY MANAGEMENT ELEMENT

FACILITY NAME	Unocal Chemi	icals - Carteret, NJ		SW 10 NO MW-13	
LAS NAME		atories, Wappingers F	alls. NY		
בו [5]	NJPOES NO. 0 0 2 6 0 7 7	WELL PERMIT NO.  2 6 - 0 9 3 5 0 -2	SAMPLE DATE YR.   MO.   DAY   8   9   0   2   0   6   11   22	7 3 4 6 0 23 2:	WOM USE
THE SCHEDULE	INDICATED BELOW IS	TO SE OBSERVED FROM DIR			
£11491114	AAGAITUG	<u>SUBMIT WITH SIGN</u>	ED T-VWX-014		
SAMPLING G G G G G G G G G G G G G G G G G G G	- · -	ANALYSIS	UNITS	PARAMETER	VALUE .
	Mai	thaxychiar, Tatal	UG/L	394801	11111

		S	البلد	PLI	NG	MC	JW.	TH:	S						3
. 4	feb.	Z.	Apr.	Kay	4	Jel Y	Į.	ž	<u>0</u> 61.	No.	D.	ANALYSIS	UNITS	PARAMETER	VALUE
										1		Methaxychiar, Tatal	UG/L	3 9 4 8 0	TITIT
										Ī		Methylene Blue Active Substances	MG/L	3 8 2 5 0	
				-								Nitrogen, Ammonia, Dissolved NH3 + NH4 as N	MG/L as N	0 0 6 0 8	111111
					1	-				<u> </u>		Nitrogen, Nitrate Dissolved	MG/L as N	0 0 6 1 8	
	-		_									Odar	T.O.N.	0 0 0 8 5	
	-		X		1							эН	Standard Units	00400	7 . 4 7
		1		1	1	1	- 1	-				Phenois, Total Recoverable	UG/L	3 2 7 3 10	1 1 1 1 1 1
	1			T			ļ					Radium 225, Dissolved	PC/L	0 9 5 0 3	
		1	1		1	1	1					Radium 223, Dissolved	Pc/L	8 1 3 6 6	
			1				Ī	Ī	-			Selenium, Dissalved	UG/L	0 1 1 4 5	11111
	1	-	1	1	1	1		1				Silver, Dissalved	UG/L	0 1 0 7 5	
	1			1		1	1	-				Sadium, Dissolved	MG/L	0 0 9 3 0	
		1)	Χį		1	i	1	١	Ĭ			Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	010191415	
M	-	!>	$\langle$	-	1)	1		I)	X	-		Total Dissolved Solids (TDS)	PPM	7 0 3 0 0	2   5   5
$\Box$					1	Ì	Ī	Ī	Ī			Total Organic Carbon (TOC)	PPM	0 0 5 8 0	
	$\perp$	1			T		-	-	1	Ī	T	Total Organic Halogen (TOX)	UG/L	7 0 3 5 3	
			Ī		1	1	1	Ī	Ī	Ī	T	Taxagnene	UG/L	3 9 4 0 0	!
		Ī	T	Ī	<u> </u>	Ī		1	1	-	Ι	Turbidity	NTU	0 0 0 7 5	11111
	Ī	ΙX	<u> </u>		Ī	ı		Ī	i			Zinc, Dissaived	UG/L		
	1	Ī	1				1	T	Ī	1	T	2, 4-0, Tatal	UG/L	3:913:710	1   1   1
			1	Ĺ		Ι			Ī			2, 4, 5—TP, Tatal	UG/L		
			L		-	Ī			Ī	T	T				
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# NO:TDETOPP JATHAMNORIVNE ROTHENTRAKED VEZREL WEN ZEDRUCZER RETAW RO NOIZIVIO

### WATER CUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PLEASE	TYPE OR	PRINT WITH	BALLPOINT PEN	í
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FACILITY NA	UnocalChemic	al _ Carteret, NJ		5.0 10 NO. MW-13		
MANC	NANCO Labor.	) Laboratories- Wappinger Falls, NY				
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LAS CERT, NO.	WOM USE	
T	WI d d y e d y y	216-019131510-2	8 9 0 2 0 6 1 17 22	13 4 d d		

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 0. 48 TO 0 18 9 12

## SUBMIT WITH SIGNED T-VWX-014

Feb. Mar. May July Sept. Oct.	MALYSIS	UNITS	PARAMETER	VALUE
TXTXTXT	Acrylonitale	UG/L	3 4 2 1 5	
	Benzene	UG/L	34101310	
	Bromoform	UG/L	3 2 1 0 4	11.10
1 11: 1 11: 1 11: 1	Carbon Tetrachtoride	UG/L	3 2 1 0 2	1 .!0
1 11 1 11 1 11 1	Chloropenzene	UG/L	3 4 3 0 1	1 1 1 11.10
	Chlorodibromoethane	UG/L	3 4 3 0'6	1     1   1   -   0
	Chloroform	UG/L	3 2 1 1 0 1 6	11.10
1 111 1 111 1 111 1	1, 1 - Dichtgroethane	UG/L	3 4 4 19 16	1 1 1 11.12
1 111 1 111 1 111 1	1, 2 - Dichtorgethane	UGAL	3 4 15 13 1	1 1 11.10
1 111 1 111 1 111 1	1, 1 - Dichtoroethylene	UG/L	3 4 5:0:1	
1 111 1 111 1 111 1	1, 2 - Dichloropropane	UG/L	3 4 5 4 1 1	1   D
1 111 1 111 1 111 1	Emvibenzene	UG/L	3 4 3 7 1	1 1 1 11 1 10
	Methylene Chloride	UG/L	3 4 4 2 3	1   . 10
1:1:1:1:1:1:1	1, 1, 2, 2 - Tetrachtorpethane	UG/L	3 4 5 1 5	1 1 11 0
1 111 1 111 1 111 1	Tetrachioroethylene	UG/L	3 4 4 7 7 5	1 1 111.0
1 111 1 111 1 111 1	Taluene	UG/L_	31410:1 2	11.0
1 111 1 111 1 111 1	1, 1, 1 - Trichloroethane	UG/L	314 5:016	1   1   9   6
1 111 1 111 1 111 1	1, 1, 2 - Trichloroethane	UG/L	314/5/1/1	1 1 0
1 111 1 111 1 111 1	Trichlaroethylene	UG/L	3 9 1 3:0	1     111.10
1 111 1 111 1 111 1	Vinyl Chloride	UG/L	3:911'7 5	· : ! [1:.:0
1 :11 1 111 1	Acrolein	UG/L	31412'1 0	2:5
1 11 1 1 1 1 1 1 1	Chioroethane	UG/L	31413:1.1	1,1,.0
1 11 1 11 1 11 1	Z - Chiaroemyivinyi Emer	UG/L	3141517 5	:
1 11 1 1 1 1 1 1	Dichtgragromgmethane	UG/L	3 2 1.3 5	111.10
	1, 3 - Dicatoragragylene	UG/L	314 6:9:3	1 1 11.10
	Methyl Bramide	UG/L	3 4 4 1 1:3	1 1 1 11.10
1 :1, 1 111 1 111 1	Metnyi Chloride	UG/L	3 4 4 4 1 1 3	1 11.0
1:1:1:11	1, 2 - trans - Dichlargethylene	UG/L	314:5:4:5	1 11.0
1 1 1 1 1 1 1 1 1	1, 2 Dichloropenzene	UGIL	314151315	1 11.10
1:,1   11   11	1, 3 Dichloropentene	UG/L	31415;5.5	11:0
1 1 1 1 1 1 1 1 1 1	1, 4 Dichtgrocentene	UG/L	31415(711)	11.0
ONA SEJUR DNIOCO BULES			29 JJ J4 42 46 47 33 39 50 68 72 73	10 32 77

Ferm VWX-017 UZD P1

VALUE COOING RULES AND

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID, BASE/HEUTRAL ORGANIC COMPOUNDS

PLEASE TYP	E OR PRINT MITH BALLPOIN	TPEN		ISM ID NO.			
FACILITY A	Unoc3	1 Chemical - Carteret,	MW-13				
LAS HAME	· NANCO Labora	tories - Wappingers Fa	lls NY				
Ō	N. 0 0 2 6 0 7 7	26-09350-2	890205	M LAB CERT. NO.	MCM (ZE		

THE SCHEDULE INDICATED BELOW IS TO SE OSSERVED FROM 10,818,81 TO 10,89 7

	SUBHIT WITH SIGNED T-FW	T-014	·	_
SAMPLING MONTHS	•			VALUE
44341444	· ANALYES	UNITS	PARAMETER	VALUE
THE REPORT OF TH	2-Chlorophenol	ug/1	3 4 5 3 5	<u> </u>
	2,4-Dichlorophenol	ug/l	3 4 6 0 1	
	2,4-Dimethylphenol .	ug/l	3 4 6 0 6	11111
	2,6-Dimitro-o-cresol	ug/1	. 7 7 6 0 3	
	2,4-Dinitrophenol	ug/1	346116	
	2-Hitrophenol	ug/1	3 4 5 9 1	
	4-Nitrophenol	ug/I··	3 4 6 4 9	
	p-Chloro-z-cresol	ug/1	3 4 4 5 2	11111
	Pentachlorophenol '	ug/1	3 9 0 3 2	
	Phenol	ug/1	3 4 6 9 5	
	2.4,6-Trichlorophenol	ug/1	3 4 6 2 1	11111
				11111
<del></del>	Acarehana	uz/1	13/4/2/0/5	11111
	Acenaphthylene	ug/1	3 4 2 0 0	
	Anthracene	ug/l	3 4 2 2 0	1 1 1 1 1 1
	Benzidine	ug/l	3 9 1 2 0	1 1.1 1 1
	Benzanthracene	ug/1	3 4 5 2 6	11111
	Beniopytene	ug/l	3 4 2 4 7	11111
	3,4-Benzofluoranthene	ug/1	3 4 2 3 0	
	Benzoperylene	ug/l	3 4 5 2 1	
	Benzofluoranthene	ug/1	3 4 2 4 2	
	Bis(2-chloroethoxy)methame	ug/l	3 4 2 7 8	
	Bis(2-chloroethyl) Ether	ug/1	3 4 2 7 3	
	Bis(2-chlroisopropyl) Ether	ug/l	3 4 2 8 3	
	Bis(2-ethylhexyl) Phchalace	ug/l	3 9 1 1 0 0	
	4-Bromophenyl Ether	ug/l.	3 4 6 3 6	
	Butylbenzyl Phthalate	ug/l	3 4 2 9 2	
	Z-Chloropenhebalene	u2/1	3/4/5/0/1	
	total buil Bhomil Feber	ug/1	3 4 6 4 1 1	

27 42 64

Fem YWX-017 4/83 P2

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

please type of print mith ballpoint per	,
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VALUE CODING RULES AND REMARK CODES ON REVERSE

MANCO Laboratories - Wappingers Falls, NY

NANCO Laboratories - Wappingers Falls, NY

SAMPLE DATE

TEL PERMIT NO.

TEL PERMIT NO.

TEL MO. IDAY

NJ 0 0 2 6 0 7 7 2 6 0 9 3 5 0 - 2 8 9 0 2 0 6 7 3 4 6 0

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 0 18 18 TE TO 10 18 912

## SUBMIT WITH SIGNED T. PWX-014

SAMPLING MONTHS											
1111111111 .	ANALYES	UNITE	₽.	ARA	ME	TER			VAL	ure	
Chrysene		ug/1	3	4	3	2 0			T	П	TT
Dibenzanthr	acene	ug/1	3	4	5	5/6			T		++
1,2-Dichlor	opezzene	ug/l	3	4	5	3 6		Ī	T		11
1,3-Dichlor	phenzene	ug/l	3	4	5	5 6	П	T		H	++
1.4-Dichlor	benzene	ug/l	3	41	5	7 1	П	Ì	T	İ	11
3,3'-Dichlo	robenzidine	ug/1	3	41	5 .	3/1	П	Ì			++
Diethyl Pht	nalate	ug/1	[3]	4	31.	3 6	П	十	П		++
Dimethyl Ph	halate	ug/1	3	4	3 4	1		Ť	Ħ	1	$\forall$
Di-n-butyl 1	hthalate	ug/1		9 1	_	_	T	Ť	Ħ	十	++
2,4-Dimitro		ug/1		4 6	_			Ť	ii	十	+
2,6-Dinitro	olulese	ug/1		4 6	_		Ì	Ť	Ϊİ	Ť	††
D1-a-octyl B	hthelate	ug/1	3	4 5	9	6	Ť	Ť	H	十	11
1,2-Diphenyl	hydrazine	ug/1		4 3	<u>.                                    </u>	-	Ť	Ť	$\Box$	十	$\vdash$
		ug/1	3	4 3	7	6	Ť	Ť	İΪ	i.	<del>i                                     </del>
Fluorene		ug/1		6 3	-	-	Ť	Ť	Ħ	1	
Hexachlorobe	ziene	ug/1	3	_	-	$\rightarrow$	Ť	Ì		Ť	$\vdash$
	tadiese	u2/1		. 3			İ	<del>i</del>	<u> </u>	İ	$\sqcap$
Hexachlorocy	clopentadiene	ug/1	<del></del>	1 3			Ť	Ť	Ť	Ť	
	1406	ug/1	314	3	9	6	T		T	T	$\sqcap$
Indenomyrene		ug/1	314	. 4	0	3	T		T		
Isophorone		ug/1	13/4	+			Ī	П	T	T	
		uz/1	3 4	6	91	6	Ť		T		
Nigrabenzene		uz/1	3 6	141	41	7	Ī	11	T		$\Box$
H-Wiengerdin,		uz/1	13/4	<del>-</del>		-+	Ť	Π	T	11	$\sqcap$
N-Nitrosodi-		ug/1	1314		_	8	Ť	11	T	11	$\top$
		ug/1	3 4			_	Ť		T	11	T
		· ug/l	3 4				Ť	ΠÌ	T	H	7
Pyrene		ug/1	13/4				†	i	Ť	11	$\top$
1,2,4-Trichlo		ug/1	<b>B</b> 4		_		$\vdash$	-	<del></del> -	$\dot{1}$	

## NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION OF WATER RESTUDIES WATER QUALITY MANAGEMENT ELEMENT

	cal Chemicals - Carteret, N	J	SM 10	10	W-13	· <del>-</del>	
NAN BALK BA	CO Laboratories - Wappinger						
NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR. 1 MO. 1 DAY 8 9 0 2 0 6		d d		₩ <b>Ċ</b> ₩ Û	is E
HE SCHEDULE INDICATED BELOW	IS TO SE OSSERVED FROM D 8 8 8   MO. YR.	то <u>018 912</u> ] мо. үх.					
Sampling Months	SUBMIT WITH SIGNED	T-VWX-014					
Feb. Mer. Mer. Mer. Mer. Mer. Mer. Mer. Mer	ANALYSIS	UNITS	PARA	METER	•	<b>/ALUE</b>	
	Specific Conductance	mhos/cm				3 1	4
	Election Devices		111				
	Floating Product	inches		111	11	111	10
			1 1 1	-	<del>- - -</del>	1 1	$\perp$
	Total Xvlenes	ug/l	+++		<del>- - -</del>	<u>    1                                 </u>	<u>- </u>
			+		1 1	<u> </u>	$\frac{1}{1}$
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			1 1 1		1!	<u>                                     </u>	÷
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## MONITORING REPORT - TRANSMITTAL SHEET

NIPOES NO.

REPORTING PERIOD .

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111818 THE [011819]

PERMITTEE:	Mancal Chemical			
	Address 1345 North Meacha	m Road		
	Schaumburg, IL	60196		
FACILITY:	Namelinocal Chemicals	Division		
	Address 350 Roosevelt Aver	nue		
	Carteret	(County) Middlesex		
	Telephane <u>( 201 ) 541- 4224</u>	<u> </u>		
	HED (Indicate Quantity of Each)	OPERATORE EXCEPTIONS		
T-VWX-00		DYETESTONG	YES	<b>№</b> 0
		TOPOGRAPY BYPASSING		<b>8</b>
SLUDGE REPORTS		DISIMPELT CN INTERRUPTION		<u> </u>
T-VWX-01	BOTO-XWV-T	MONTTORES MALFUNCTIONS		<u> </u>
WASTEWATER RE	PORTS	UNITS OUT OF OPERATION		<b>X</b>
T-VWX-011	T-VWX-012 T-VWX-013	отнея		<b>X</b>
GROUNDWATER R	EPORTS  .BI 1 VWX-016 1 VWX-017	(Deciil say "Yes" on reverse side in a <del>ppropri</del> ate space.)		
NPDES DISCHARGE	3370-1	NOTE: The "Hows Attended at Plane of this sheet must also be con		te
AUTHENTICATIO	of those individuals immediate submitted in this control of those individuals immediate submitted information is true,	that I have personally examined and am fa focument and all ambdiments and that, but by responsible for obtaining the information accurate and complete. I am aware that to a formation including the possibility of finite	ised on on, I bel here are	my ing ieve the signific
LICENSED OPERA	ATOR	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE		
Name (Printed)		Name (Processi Daryl W. Dierwecht Supervisor Environ	ter nmenta	<del>-</del>
Grade & Registry N	o	Title (Program) Affairs	<u>;</u>	<del></del>
Signature		Signature Alanh Michigan	th	<del></del>
Date		Date March 21, 1989		

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1	Licensed Operator				<u> </u>		<u> </u>											╛		
	Others	<u> </u>					_		<u></u>			<u> </u>	<u> </u>				1			
1	Day of Month	17	18	19	20	21	22	23	24	25	25	27	28	29	30	1 31				
	Licensed Operator	1 1														1				

Others

## W JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

## WATER QUALITY MANAGEMENT ELEMENT

## GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

FACILITY N.	unocal Chem:	tal Carteret N.1	<u> </u>	SW 10 NO MW-14	
ME NAME		s. Wappingers Falls	NY		
R	1.00 53 04 10 V	WELL PERMIT NO.  26-09351-1	SAMPLE DATE YR.   MO.   DAY 8   9   0   2   0   6	NJ LAB CERT. NO.  7 3 4 6 0 23 27	WOM USE
THE SCHE	DULE INDICATED SELOW IS T	O 35 085ERVED FROM 0.818			

Sampling Months				
Jan. Fati. Mar. Apr. Aug. Sapr. Oct.	ANALYSIS	UNITS	PARAMETER	VALUE
MIMIMIM	Elevation of top of well casing with cap off (as specified in well completion report)	feet MSL: to nearest .01		12.53
MIMIMIM	Elevation of original ground level (as specified in well completion report)	feet MSL: to nearest .01		13.35
MINIMIMI	Depth to water table from too of casing prior to sampling with cap off	feet: to nearest 01	8 2 5 4 6	14.97
MIMIMIMI	Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	15.79
	Arsenic, Dissolved	UG/L as As	011000	
	Barium, Dissolved	UG/L as 3a	0 1 0 0 5	1 1 1 1 1 1
	Biochemical Oxygen Demand - 5 Day	MG/L	0 0 3 1 1 0	
	Cadmium, Dissolved	UG/L as Cd	0 1 0 2 5	
MIMIMIMI	Chloride, Dissalved	UG/L as CI	8 2 2 9 5	3 2 1 0 0
	Chromium, Dissolved	UG/L as Cr	011030	11111
	Chromium, Dissolved, Hexavalent	سځ/۲ ۶۶ ۵۰	0 1 2 2 0	
	Chemical Oxygen Demand (COO), Dissolved	MG/L	0 0 3 4 1	11111
	Caliform Group	N/100 ML	7 4 0 5 6	
	Calar	Pt · Ca	olololalol	
	Cooper, Dissolved	UG/L as Cu	0 1 0 4 0	
	Cyanide, Total	MG/L as CN	0 0 17   2   0	
	Endrin, Total	UG/L	3 9 3 9 6	
	Fluoride, Dissolved	MG/L as =	0 0 9:5:0	
	Gross Alona, Dissolved	Pe/L	011150131	
	Gross Beta, Dimolved	Pe/L	0 3 5 0 3	
	Hardness, Total as CaCO <sub>3</sub>	MG/L	0 0 0 1 3 1 0 1 0 1	11111
	Iran, Dissalved	UG/L as = e	0 1 0 4 5	11111
	Lead, Dissolved	UG/L as 23	0 1 0 4 9	1 1 1 1 1 1
	Lindane, Total	UG/L	3 9 7 3 2	11111
	Manganese, Dissolved	UG/L	0   1   0 - 5   5	
	Mercury, Dissalved	UG/L	7 1 1 8 9 9	
	<u></u>	7.	2 13 14	40 •

# NOITOSTOPS LATINGMUNIUMS ANTINGUTALS CYSERS, WISH CONTOSTORY ON MOISIVIO

4/83	MATER QUALITY MANAGAMENT EL	EMENT		
G	ROUND WATER ANALYSIS – MONITOR	ING WELL R	EPORT	
PLEASE TYPE OR PRINT WITH BALL	POINT PEN		SW 10 W	
FACILITY NAME Unocal C	hemicals - Carteret, NJ		SW 10 NO MW-14	
1 10 41145	shoratories Wappingers Falls NY			
nipoes no.	27WLC	E DATE O.   DAY	NJ LAB CERT, NO.	WOM USE
S N=0 10 12 16 10 17	<u> </u>		7 3 4 6 0	-33
THE SCHEDULE INDICATED BELO	OW IS TO BE OBSERVED FROM ON YA. TO	0 18 19 12   NO. YA.		
	SUBMIT WITH SIGNED T-YWX-	014		ço.
SAMPLING MONTHS				VALUE E
P K P F F F F F F F F F F F F F F F F F	T	UNITS	PARAMETER	VALUE E
	Methaxychlar, Tatal	UG/L	3 9 4 8 0	
	Methylene Blue Active Substances	MG/L	38250	
	Nitrogen, Ammonia, Oissolved NH <sub>3</sub> + NH <sub>4</sub> as N		0 0 6 0 3	
	Nitragen, Nitrate Dissalved	MG/L as N	0 0 6 1 8	
	Odar	T.O.N.	0 0 0 9 5 1	
	эн	Standard Units	00400	7 - 4 1
	Phenois, Total Recoverable	UG/L	3 2 7 3 10	
	Radium 225, Dissolved	Pc/L	0 9 5 0 3	
	Radium 228, Dissolved	Pe/L	8 1 3 5 6   1	
	Selenium, Dissolved	UG/L	0 1 1 4 5	
	Silver, Dissalved	טפער	0 1 0 7 5	
	Sadium, Dissalved	MG/L	0 0 2 3 0 1 1	
	Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	alaisia	!
N N N N	Tatal Dissolved Solids (TDS)	SoN	7 0 3 0 0 1	5 1 2
	Total Organic Carbon (TOC)	PPW	0 0 5 8 0 1	
	Total Organic Halogen (TOX)	UG/L	7 0 3 5 3 1	
	Toxagnene	UG/L	3 9 4 0 0 1	
	Tuesday	NTU	00075	

1111 0.6.0110 UG/L Zinc, Dissolved ł UG/L 319131710 2, 4-0, Total 3 3 0 4 5 UGIL 2, 4, 5-TP, Tatal 1 ļ

VALUE COOING RULES AND REMARK CODES ON REVERSE 29 42 55 68

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33 34 44 47 79 40

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION OF WATER RESURCES

WATER CUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

PERACE TYPE OF PRINT WITH ALL POINT PEN

FACILITY NA	unocalChemic	al _ Carteret, NJ		5.4 10 NO MW-14	
LAB NAMÉ		atories- Wappinger Fal	ls. NY		
	NJPOES NO.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	UB CERT NO.	NCM USE
	NJ ddsdd 71 7	2 6 0 9 3 5 1-1	8 9 0 2 0 6	13 4 4 4	

THE SCHEDULE INDICATED SELOW IS TO SE OBSERVED FROM 0. 17. TO 0.8 9 12 1

## SUBMIT WITH SIGNED T-VWX-014

MA A A A A A A A A A A A A A A A A A A	VALYSIS UNITS	PARAMETER	VALUE
Acrylanitrile	UG/L	3 4 2 1 5	
	UG/L	3 4 0 3 10	1
	UG/L	3 2 1 1 0 4	1 -  0
	e UG/L	3 2 1 0 2	1  - 10
	UG/L	3 4 3 9 9 1	1 . !0
	e UG/L	3 4 3 0'6	1 .  0
	UG/L	3 2 1 0 6	1 .10
	UG/L	3 4 4 19 6	1 .0
	UG/L	314 5 3 1	1 1 1 1 1 1 0
	ne UG/L	3 4 5 0!1	11.i0
	e UG/L	3 4 5 4 1	1     11-10
Ethylbenzene	UG/L	3 4 3 7 1	1       4 .13
	UG/L	3 4 4 2 3	1   11-10
	persane UG/L	3 4 5 1 5	1 11.0
Tetrachigroethylene	UG/L	3 4 4 7 5	1 1 111-0
	UG/L	3 4 0 1 7 2	1 . 0
1 :   1	ne UG/L	3 4 5 0 5	1 1 1 1 1 0
	ane UG/L	3 4 5 1:1	1 . 0
	UG/L	3 9 1 3:0	1   11-10
	UG/L	3191117 5	1 . 0
	UGIL	3141211 0	2 5
	ug/L	31413:1.1	. 1 . 0
	ther UG/L	3141517.5	1 i 1 i <b>1</b> i 0
111	ne UG/L	3 2!1:0-5	1 1 1 1 0
	ne UG/L	314[5:9:9	1 1 1 0
Metnyi Bromide	UG/L	3 4 4 1 1 1 3	1 1 1 1 0
Methyl Chloride	UG/L	3 4 4 1 1 3	1 1 1 0
	strylene UG/L	314:5:4:5	11.0
	UG/L_	31415:3!5	: : 11, 0
	UG/L	31415,5.5	11.0
	UG/L	31 41 51 70 1   122	; [1].:0

Form YMX-017 P1

# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT

FACILITY M	E OR PRINT MITH BALL	nocal Chemical - Carteret	, NJ	SW 10 NO. MW-14	
LAS HAME	- NANCO La	boratories - Wappingers E	alls NY		
Ō	NJ002607	WELL FERMIT NO.	890206	MI LAS CERT. NO.	MCW (ZEE
THE SCHEE	DULE INDICATED BELD	8 8 0 more caveasso as or as w	3 8 TO [018] 912]		
THE SCHEE	DULE INDICATED BELO	MOST TO BE OBSERVED FROM THO MO.	•		

SAMPLING MONTHS	•			
44141441441	ANALYES	UNITS	PARAMETER	VALUE
	2-Chlorophenol	ug/1	3 4 5 8 6	<u> </u>
	2.4-Dichlorophenol	ug/l	3 4 6 0 1	
	2.4-Dimethylphenol .	ug/1	34606	11111
	2,6-Dinitro-o-cresol	ug/1 ·	. 7 7 6 0 3	<u> </u>
	2,4-Dinitrophenol	ug/1	346116	<u> </u>
	2-Hitrophenol	ug/1	3 4 5 9 1	
	4-Nitrophenol	ug/I··	3 4 6 4 9	
	p-Chloro-m-cresol	ug/1	3 4 4 5 2	<u> </u>
	Pentachlorophenol '	ug/l	3 9 0 3 2	
<del>-                                     </del>	Phenol	ug/1	3 4 6 9 5	
	2.4,6-Trichlorophenol	ug/1	3 4 6 2 1	
<del>-                                     </del>				1   1   1   1
	Acarentehana	42/1	3/4/2/0/5	
	Acenaphthylene	ug/1	3141210101	
	Anchracene	ug/1	3 4 2 2 0	
	Benzidine	ug/1	3 9 1 2 0	
	Benzanthracene	ug/1	3 4 5 2 6	
	Benzopyrene	ug/1	3 4 2 4 7	
	3.4-Benzofluoranthene	ug/1	3 4 2 3 0	
	Benzoperylene	uz/1	3 4 5 2 1	
	Benzofluoranthene	ug/1	3 4 2 4 2	
	Bis(2-chloroethoxy)methane	ug/1	3 4 2 7 8	
	Bis(2-chloroethyl) Ether	ug/1	3 4 2 7 3	
	Bis(2-chlroisopropyl) Ether	ug/1	3 4 2 8 3	
<del></del>	Bis(2-ethylhexyl) Phthalate	ug/1	3 9 1 0 0	
	4-Bromophenyl Ether	ug/1.	3 4 6 3 6	
		ug/1	3 4 2 9 2	
<del>- - - - - - -</del>	Burylbenzyl Phthalate	uz/1	3/4/5/8/1	
<del></del>	2-Chlorenaphrhalene	ug/1	314161411	TITLL
	4-chieronhenyl Phenyl Ether	I UE/A	12:2:0:2:4	40 4

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### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

MCLJ,	BY25/VEDIXYE	OKCYNIC	COMPOUNDS

SW 10 NO. MW-14 FACILITY NAME Unocal Chemicals - Carteret, NJ LAC . AME NANCO Laboratories - Wappingers Falls, NY SAMPLE DATE MUTCEE NO. WELL PERMIT NO. NI LAS CERT, NO. TR. | MO. | DAT WCH LEE 26-093511-1 回 890206

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM | 0 8 8 8 7 TO | 0 18 9 12 TO | MA TE

### SUBMIT WITH SIGNED T. FWX-014

SAMPLING MONTHS			•	ž.
11111111111	MALTER	UNITE	PARAMETER	ATTRE ME
	Chrysene	ug/l	3 4 3 2 0 1	
	Dibenzanthracene	ug/1	3 4 5 5 6	
	1,2-Dichlorobenzene	ug/1	34536	
	1.3-Dichlorobenzene	ug/l	3 4 5 6 6	
	1,4-Dichlorobenzene	ug/1	34571	
	3,3'-Dichlorobenzidine	ug/1	3 4 6 3 1	
	Diethyl Phthalate	ug/1	3 4 3 3 6	TITI
	Dimethyl Phthalate	ug/1	3 4 3 4 1	
	Di-n-butyl Phthalate	ug/1	3 9 1 1 0	
	2,4-Dimitrotolulene	ug/1	3 4 6 1 1	
	2,6-Dimitrotolulene	ug/l	3 4 6 2 6 1	
	Di-m-octyl Phthalate	ug/l	3 4 5 9 6	
	1.2-Diphenylhydrazine	ug/l	3 4 3 4 6	
	Fluoranthene	ug/1	3 4 3 7 6 1	
	Fluorene	ug/1	3 4 3 8 1	
	Hexachlorobenzene-	ug/1	39700	
	Hexachlorobutadiene	ug/1	3 4 3 9 1	
	Hexachlorocyclopentadiene	ug/1	3 4 3 8 5 1	1111
	Rexachloroethane	ug/l	3 4 3 9 6 1	
	Indenopyrene	ug/1	3440311	
	Isophorone	ug/1	34408	
	Maphthalene '	ug/1	346961	
	Mirrhenrene	ug/1	3444711	
	H-Witzagadinantlyamine	WZ/1	13/4/4/3/3/1	
	N-Mitrosodi-n-propylsmine	ug/1	3 4 4 2 8 1 1	
	N-Wittosodiphenylamine	ug/l	3 4 4 3 3 .1 1	
	Phenanthrene	- ug/l	3 4 4 6 1 1	
	Pyrene	ug/1	3 4 4 6 9 1 1	
	1.2.4-Trichlorobenzene	uz/1	D 4 5 5 1 1 1	

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## NOITESTOPS LETMANDRIVMS AD TMANTRESSO YSSRB! WBM DIVISION OF WATER RESOURCES TMAMELE TMAMEDAMAM YTIJAUD RETAW

## GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACILITY NAME	Uno	cal Chemicals - Carteret, NJ		SW 10 NO	MW-	14
AB NAME		ICO Laboratories - Wappingers F	alle NV	<del></del>		
			PLE DATE			
	NJPOES NO.	WELL PERMIT NO. YR. 1	HO.   DAY	NJ LAB CE		WCM USI
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THE SCHEOUSE	MOICATED REFOR	US TO TE ORGEN ED STON D 8 18 18 1	10,819,21			
16		TO TO SE OBSERVED PROM [8 8 8] TO	MO. YR.			
	<b>- - -</b>	SUBMIT WITH SIGNED T-VI	V.X-014			
Sampling						
Fob.	Aug. Sapi. Oct. Nav.	ANALYSIS	UNITS	PARAM	TER	VALUE
X     2		Specific Conductance	mhos/cm			
					11	
X		Floating Product	inches		1	
				1111	T	
		Total Xvlenes	ug/l	<del>-                                      </del>	1	111.
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# NEW JERSEY DEFARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

## MONITORING REPORT - TRANSMITTAL SHEET

	NIPOES NO.	REPORTING PERIOD		
·	0:0:2:6:017:7	HO. YR. HO. YR.		
PERMITTEE:	Mane			
	Address 1345 North Meacham R	oad		
	Schaumburg, IL	60196		
FACILITY:	Name Unocal Chemicals Div	ision		
	Address 350 Roosevelt Avenue	· · · · · · · · · · · · · · · · · · ·	<del></del>	
	Carteret	(County) Middlesex	<del></del>	
	Telephone 1 201 1 541- 4224	·· <del></del> •		
FORMS ATTACH	ED (Indicate Quantity of Each)	OPERATORS EXCEPTIONS	•	
SLUDGE REPORTS	SANITARY		YES	NO
T-VWX-007	T-VWX-008 T-VWX-009	DYETESTOIG		$\nabla$
SLUDGE REPORTS	INDUSTRIAL	DNIZZATYB YRARCTIGT		
T.VWX-010	A T-VWX-010B	DISTRIPECTION INTERRUPTION		
WASTEWATER REM	DRTS	MONTORAGE MALFUNCTIONS		
T-VWX-011	T-VWX-012 T-VWX-013	UNITS OUT OF OPERATION		0XC] 0XC]
GROUNDWATER RE	PORTS  B) 1 VWX-016 1 VWX-017	(Describery "Yes" on reverse side in expression space.)	_	
NPDES DISCHARGE	монітоянь в <del>пероя</del> т 1320-1	NOTE: The "Hours Attended at Plan reverse of this sheet must also be com	it" on th	ie
AUTHENTICATION	information submitted in this doct of those individuals immediately re submitted information is true, acc	I have personally examined and am far ument and all amodiments and that, ba exponsible for oppoining the informatio urate and complete. I am aware that the mation inducing the possibility of fine	sed on a n, I beli tere are	my inquieve the signific
LICENSED OPERA	•	PRINCIPAL EXECUTIVE OFFICER or DULY AUTHORIZED REPRESENTATIVE		
Name (Printed)	<del></del>	Name (Press) Daryl W. Dierwecht Supervisor Enviror	er	<del></del>
Grade & Registry No		Supervisor Environ Affairs	<u> </u>	<u>.</u> 
Signature		Signature And Company	<u>~2.17</u>	<u>. L., </u>
Date		DateMarch_21, 1989		

PERAT	ING EXCEPTIONS DETAILE	<u>D</u>																	
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## NOITSETORS JETNAMNORIVNE ROTHANTRESS VERREL W. ZEDRUOZER RETAW RO NOIZIVIO

### WATER QUALITY MANAGEMENT ELEMENT

### GRU. 10 WATER ANALYSIS - MONITORING WELL REPORT

	JTY NA	ME	iinac	3 !		Chem	ta <u>l Carteret N.I</u>			SW	10	N	)	М	W-	16					
N 8 KJ	AME						,	<del> </del>	<del></del>	<u> </u>		_				_	_	_			_
L		NANE	10 L	ap	or,	atorie	s. Wappingers Falls, NY		. = 4			_						_	=	_	_
			NJPO	ES	NO	ı <b>.</b>	WELL PERMIT NO.	SAMPLE D R.   MQ.		NJ	ب	8 (	EA	T. /	٧O.			1	YQ.	4 US	ε
	R	NJ d	d 2	6	d	7 7	26-0193153-7			7	3	4	16	lo						7	
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THE	SCHE	DULE INC	الما	<b>E</b> D	9 E	FOM IZ	TO 35 085ERVED FROM 018 818	דם [0]	8 9 2 0. YR.												
							SUBMIT WITH SIGNED T	VWX-014	<u>-</u>												
	SAMP	LING MO	NTHS																		
4 3 4 3	, A K	\$ \$ \$	Sept.	ਰ ਹ	Ž Š	y o	ANALYSIS		UNITS	P	AR	**	ET	ER			_	ALI	JE		
MΙ	X	IM	10	XI	-		ation of top of well casing with cap off pecified in well completion report)		et MSL: nearest .01									9		2	3
M	M	T M	1 1	X	ᅡ		stion of original ground level		et MSL:	$\dagger$	_	_			$\dagger$	$\dagger$	<del> </del>				Ť
M	W	1 1	+ 4	<u>٨</u>	_	(as s	pecified in well completion report)		nearest .01	$\downarrow$		_	_		$\downarrow$	Ļ	<u> </u>	9	.	6 (	2
$X \mid$	X	IX		X			th to water table from top of casing pricating with cap off	or ta	feet: to nearest 01	8	2	5	4	6							
XI	X	TX	T				h to water table from original ground loor to sampling	evel	feet: to nearest .01	7	2	a	1	9	Γ						T
XI	X	TIX	T	<b>₹</b>	Ī	Arse	nic, Oissolved		UG/L as As	0	1	a	lo	0	Τ	1	1	П	- 1	$\top$	T
1		TIT	H	T	1	Bariu	m, Dissolved		UG/L as 3a	0	1	0	lo	5		ı	ļ		ı	1	T
	TI	111	11		T	Bioc	remical Oxygen Demand - 5 Day		MG/L	0	0	3	1	0			1			T	T
	11	111	TT	7	T	Cadn	nium, Dissalved		UG/L as Cd	0	1	٥	2	5					- 1	$\top$	T
XII	X	TX	T	$\overline{\mathbb{Q}}$	T	Chio	ide, Dissalved	. [	UG/L as CI	8	2	2	9	5						1	T
	11		11			Chro	nium, Dissolved		UG/L as Cr	0	1	0	3	0				-	1		I
	11	111		1		Chro	nium, Dissalved, Hexavalent		الگراد ۲۰ در	0	1	2	2	O				Ī			Ī
		111	11	T	Ī	Сћеп	ical Oxygen Demand (COD), Dissalved		MG/L	0	0	3	4	1			1	Ī	Ī		I
11			11	I	Ī	Calife	orm Group		N/100 ML	7	4	0	5	6							I
11	11	111		Ī	ļ	Calor			Pt · Ca	0	0	0	8	0	1						L
11	11	1   1	11	T	T	Capo	er, Dissolved		UG/L as Cu	0	1	0	4	0				Ī		1	
11			11	T	T		de, Total	МС	I/L as CN	0	٥l	7	2	0		- 1	1			1	I
		1   1	1	Ī	1	Endri	n, Total	1	JG/L	3	<b>9</b>	3 i	9	0	-	1	-		Ī		
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11			11	Ī	1	Harch	ess, Total as CaCO <sub>3</sub>	۸ ا	AG/L	0 0	ין כ	9	0	0	1	1	Ī	Ī	1	T	Γ
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Ti				Ī	Ī	Lindar	ne, Total	T.	IG/L	3   9	1	7	8	2	1	1	-		I	Ī	Ī
TT		11	i	Ī	1	Manga	nese, Dissalved	-	IG/L	0   1	1	۱.	5	5	-	Ī	1		1	1	
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# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION 220RUD29R RETAIN RO NOISIVIO

## WATER QUALITY MANAGEMENT ELEMENT

	GROUND WATER ANALYSIS - MONITOR	RING WELL F	REPORT	
PLEASE TYPE OR PRINT WITH BA FACILITY NAME Unocal	Chemicals - Carteret, NJ		24 10 NO.	MW-16
LAB NAME				
NANCO	Fal <u>ls. NY یا Laboratories, Wappingers</u> عمصهر	E DATE		
MJPOES NO		40.   DAY	NJ LAB CERT. NO.	WOM USE
5 N3001216101	7 7 2 6 - 0 9 3 5 3 - 7		7 3 4 6 0	
. 2	16 17	11	23 27	
THE SCHEDULE INDICATED BE	LOW IS TO BE OBSERVED FACM 018 818 TO	0:819:21 ×0. YR.		
	SUBMIT WITH SIGNED T-VWX	-014		
sampling months				
Jan. Feb. Mar. May July Aug. Sept. Oct.	d ANALYSIS	UNITS	PARAMETER	VALUE
	Methaxychiar, Tatal	UG/L	39480	
	Methylene Blue Active Substances	MG/L	3 8 2 6 0	
	Nitrogen, Ammonia, Dissolved NH3 + NH4 as N		0 0 6 0 8	
	Nitragen, Nitrate Dissolved	MG/L as N	0 0 6 1 8	
	Odar	T.O.N.	0 0 0 3 5	
X I X I X I X I	эн	Standard Units	00400	
	Phenois, Total Recoverable	UG/L	3 2 7 3 10	
	Radium 225, Dissolved	PeiL	0 9 5 0 3	
	Radium 229, Dissolved	P=/L	8 1 3 6 6	
	Selenium, Dissalved	UG/L	0 1 1 4 5	
	Silver, Dissolved	UG/L	0 1 0 7 5	
	Sadium, Dissalved	MG/L	0 0 9 3 0	
X I X I X I X	Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	0 0 9 4 6	!
X I X I X I X	Tatal Dissalved Salids (TDS)	50·N	7 0 3 0 0	
	Total Greanic Carbon (TOC)	PP:M	0 0 8 8 0 0	
	Total Organic Halogen (TOX)	UG/L	7 0 3 5 3 1	
	Toxagnene	UG/L	3 9 4 0 0 1	11111
	Turbidity	טדע	0 0 0 7 5	11111
	Zinc, Dissalved	UG/L	i loie oliio	
	2. 4-0. Total	UG/L	3 3 3 7 0 1	11111
	2, 4, 5-72, Taral	UG/L	3 9 0 4 5 1	
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# NOITDETOPP JETRAMMORIUME ROTMENTAL PROTECTION CEDANORIUME RESEAU NOISIVIO

### THAMELE THAMEDANAM YTIJAUD RETAW

# GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

•	 	~ ~	PRINT WITH	3 411	BOINT	364

FACILITY NA	ME UnocalChemic		15.0 10 40 MW	I-16	
عسده فس	NANCO_Labor	atories- Wappinger Fal	ls. NY		
	nipoes no.	WELL PERMIT NO.	SAMPLE DATE YR.   MO.   DAY	LAB CERT, NO.	WOM USE
	un ad sed siz	216-019131513-7	17 12	री य व व व	

THE SCHEDULE INDICATED BELOW IS TO SE OBSERVED FROM 0 18 8 18 TO 018 912

# SUBMIT WITH SIGNED T-VWX-014

Sampling months				VALUE
Jan. Mar. May. May July Aug. Sapt. Nov.	ANALYSIS	ZTINU	PARAMETER	VALUE
MINIMI	Acrylonitrile	UG/L	3 4 2 1 1 5	
	Benzene	UG/L	3 4 0 3 0	11111
	Bromoform	UG/L	3 2 1 1 0 4	
	Carbon Tetrachloride	UG/L	3 2 1 0 2	
	Chlaragenzene	UG/L	3 4 3 0 1	11111
	Chlorodibromœthane	UG/L	3 4 3 0:6	11111
	Chigrafarm	UG/L	3 2 1 1 0 1 6	
	1, 1 - Dichtoroethane	UG/L	3 4 4 9 6	1111;
11 1 11 1 1 1 1 1 1 1 1	1, 2 - Dichtoroethane	UG/L	314 5 3 1	! ! ! ! ! !
	1, 1 - Dichlaroethylene	UG/L	314 5 0 1	1
	1, 2 · Dichloropropane	UG/L	3 4 5 4 1	1 1 1 1 1
	Emvibenzene	UG/L	3 4 3 7 1	11111
	Methylene Chloride	UG/L	3 4 4 2 3	
	1, 1, 2, 2 - Tetrachiorpethane	UG/L	3141511-5	1111
11 1 11 1 1 1 1 1 1 1 1	Tetrachloroethylene	UG/L	3 4 4 7:5	1111
11 1 :11 : [1: 1 : [1 1	Taluene	UG/L	3 4 0 1 2	
11 1 : 1 : 1 : 1 i i i i i i i i i i i i	1, 1, 1 - Trichtoroethane	UG/L	31415:0.6	
11 1 11 1 1 1 1 1 1 1 1	1, 1, 2 - Trichtoroethane	UG/L	314/5/1/1	1 1 1 1
11 1 11 1 1 1 1 1 1 1 1	Trichloroethylene	UG/L	3 9 1 3:0	
11 1 11 1 1 1 1 1 1 1 1	Vinyl Chloride	UG/L	3:911'7 5	1 1 1 1 1
In a file to the file of the f	Acraiein	UG/L	314 2 1 0	
11 1 1 1 1 1 1 1 1 1 1 1	Chioroethane	UG/L	314 3::.1	1 1 1 1
[]	2 - Chloroemvivinyl Etter	UG/L	3;4 5.7.6	
11 1 : 1 ! 1   1   1   1   1	Dichtoropromomethane	UG/L	3 2 1.3:5	:
11 1 11 1 11 1 11 1	1, 3 - Dicataragrapytene	UGIL	3 4 6 9 9 1	1 1 1 1 1
	Methyl Bromide	UG/L	3 4 4 1:3 :	1 1 1 1 .
11 1 11: 1 111 1 111 1	Metnyi Chiaride	UG/L	314141118	1 1 1 1
11 1 11: 4 11: 1 11: 1	1, 2 - trans - Olontorgemytene	UG/L	314:5:4:5 1	1 1 1 1 ;
	1, 2 Dichigrapenzene	UG/L	31415:315 1	1 1 1 1 1
	1, 3 Gichiarabenzene	UG/L	31415;5.5 1	1 1 1 1 1
	1, 4 Dichipropenzene	UG/L	314151711 1	1:11:1
VALUE COOING RULES AND REMARK CODES ON REVERS	:E		29 JJ 14 42 46 47 33 59 70 68 72 71	40 +1 31 34 57 57 73 40

Ferm VHX.017

VALUE COOING RULES AND

# MEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION OIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID. BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYP	E OR PRINT WITH BALLPOIN	IT PEN		ISM ID NO.	
FACILITY A		al Chemical - Carteret,	NJ	MW-16	
LAS HAME	- NANCO Labora	atories - Wanningers Ea	lls NY		
Ď	NJ0026077	2 6 -0 9 3 5 3 -7	TR.   MO.   DAT	7 3 4 6 Q	MCM (ZE

THE SCHEDULE INDICATED BELOW IS TO BE OBSERVED FROM 10, 8 8 8 TO 10 18 19 12

	SUBHIT WITH SIGNED T-FWX-014																							
		244	PLH	<b>~</b> G	МО	***	D45			-	•													ARK
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H	十	Ť	$\top$	1	1	7	1	7			2,4-Dichlorophenol	ug/l		-	10	-		-		1	L		$\bot$	丄
1	+	1.1	$\dashv$	1	1	1	丁	1	7		2,4-Dimethylphenol .	ug/1			16	_	_	_	1	1	L	Ц	$\perp$	$\perp$
11	十	11	$\top$	$\dagger$	1	Ť	T	iŤ	1	$\neg$	2,6-Dimitro-o-cresol	ug/1 ·	$\rightarrow$	_	16	_	_	_		1		$\sqcup$	$\perp$	$oldsymbol{\perp}$
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Ħ	十	$\Pi$	1	T	T	T	T	II	T	7	4-Nitrophenol	ug/I···		+	6	<u>.</u>	÷		1		Ш		丄	$\perp$
1	$\top$		寸	T	Ī	T	T	!	Ī	$\neg$	p-Chioro-a-cresol	ug/1		_	j4	<u> </u>		_	1	L		<u> </u>	<u> </u>	$\perp$
1	十	ii	Ť	Ť	Ť	Ť	T	H	T	7	Pentachlorophenol '	ug/1		-	0	_	_	_		1		<u> </u>	_	$\perp$
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	Ť	$\Box$	Ť	Ī	Ť	Ī	Ť	ī	T	T	Anthracene	ug/l		-	2	÷	<u> </u>	-		L		<u>: </u>	⊥	Ц
1	Ť		1	Ť	Ť	Ť	T	ī	Ī	T	Benzidine	ug/1	_ <del> </del> _	-	1	-	÷	-		L	.	<u> </u>	╀	$\sqcup$
	Ī	T	Ī	T	T	T	Ť	Ī	T	1	Benzanthracene	ug/1		<del></del>	5	-			1			<u> </u>		Ц
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	Ť		Ť	Ť	Ì	Ì	Ť	T	ī	1	3.4-Benzofluorantheme	ug/1		-	2	-			1	$oldsymbol{ol}}}}}}}}}}}}}}}}}}$			<u> </u>	$\sqcup$
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	Ť		Ť	Ť	Ť	Ť	Ť	T	T	1	Bis(2-chloroethoxy)methane	ug/1	3	4	2	7	18	1	_			4	<u> </u>	$\sqcup$
	Ť	il	Ť	Ť	Ť	Ť	Ť	Ť	T	7	Bis(2-chloroethyl) Ether	ug/1	3	4	2	7	13	3 <u> </u>	1			_	<u> </u>	Ц
<b> </b>	÷	Ħ	Ť	十	Ť	Ť	Ť	Ť	Ť	T	Bis(2-chlroisopropyl) Ether	ug/l	3	4	2	8	3	3	1			4	Щ	Ц
ıtt	i	$\Box$	$\dagger$	i	Ť	Ť	Ť	Ť	i	1	Bis(2-ethylhexyl) Phthalate 1	ug/1	3	9	1	0	10					4	<u> </u>	Ц
1	+	1 1	Ť	Ť	Ť	Ť	Ť	Ť	Ť	1	4-Bromophenyl Ether	ug/l.	3	4	6	3	16	1				_	<del>     </del>	Ц
1	Ť	Ħ	十	Ť	Ť	Ť	Ť	Ť	Ť	1	Butvibenzyl Phthalate	ug/l	$\rightarrow$	_	2		_	+		Ц	_ļ	+	$\sqcup$	H
	$\top$	H	十	Ť	$\dagger$	Ť	Ť	Ť	T	$\top$	2-Chloronanhshalene	112/1	<del></del>		5		_	<del>-</del>	1	$\sqcup$	_	+	┼┤	Н
1	Ť	11	$\top$	T	Ť	T	T	Ī	T	ightharpoons	4-Chiormhenyl Phenyl Ether	ug/1	3	4	6	4	_		1				<del>!  </del>	۲

Fem YMX-017 4/83 P2

# PEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECT : DIVISION OF WATER RESURCES THEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYP	e or print with Ballpoil	YT PEN						
FACILITY N	Unocal Ches		5w 10 NO. MW-16					
LAC AME	NANCO Labor	ratories - Wappingers F	alls. NY	TIM- 10				
•	ALFOER NO.	WELL PERMIT NO.	SAMPLE DATE . TR.   MO.   DAT	NJ LAB CERT, NO.	WCM USE			
Ā	NJObbbbb	2610935317		<u> </u>				

THE SCHEDULE INDICATED BELOW IS TO BE DESERVED FROM 10 8 8 8 TO 10 8 19 12

# SUBMIT WITH SIGNED T. FWX-014

SAMPLING MONTHS										
11111111111	ALLTES	UNITS	PARAMETER	ANTINE AND AND AND AND AND AND AND AND AND AND						
	Chrysene	ug/1	3 4 3 2 0							
	Dibenzanthracene	ug/1	3 4 5 5 6							
	1,2-Dichlorobenzene	ug/1	3 4 5 3 6							
	1,3-Dichlorobenzene	ug/1	3 4 5 6 6							
	1,4-Dichlorobenzene	ug/l	3 4 5 7 1							
	3.3'-Dichlorobenzidine	ug/1	3 4 6 3 1							
	Diethyl Phthalate	ug/1	3 4 3 3 6							
	Dimethyl Phthalate	ug/1	3 4 3 4 1							
	Di-n-butyl Phthalate	ug/1	3 9 1 1 0 1							
	2,4-Dinitrotolulene	ug/1	3 4 6 1 1							
	2,6-Dinitrotolulene	ug/1	3 4 6 2 6							
	Di-m-octyl Phthalate	ug/l	3 4 5 9 6							
	1.2-Diphenylhydrazine	ug/1	3 4 3 4 6							
	Fluoranthene	ug/1	3 4 3 7 6							
	Fluorene	ug/1	3 4 3 8 1							
	Hexachlorobenzene	ug/1	3 9 7 0 0 1							
	Hexachlorobutadiene	ug/l	3 4 3 9 1							
	Bexachlorocyclopentadiene	ug/1	3 4 3 8 5 1							
	Rexachloroethane	ug/1	3 4 3 9 6 1							
	Indenopyrene	ug/1	3 4 4 0 3 1							
	Isophorone	ug/1	3 4 4 0 8							
	Naphthalene '	ug/1	346961							
	Hirrabenzene	ug/1	344471							
	H-Wissandinanslyamine	27/1	34439							
	N-Mitrosodi-n-propylamine	ug/l	3 4 4 2 8 1							
	N-Witrosodiphenylamine	ug/l	3 4 4 3 3 .1							
	Phenanthrene	· ug/1	3 4 4 6 1							
	Pyrene	ug/l	13 4 4 6 9 1							
	1,2,4-Trichlorobenzene	ug/l	0 4 5 5 1 1							

VALUE CODING RULES AND REMARK CODES ON REVERSE

Form VWX-317 4/83

# NOITSETOPE JATHEMODRIVNE ACTHEMTRACED YESRES WEN RESTAND NOISIVIO WATER QUALITY MANAGEMENT ELEMENT

FACILITY NAME Uno	cal Chemicals - Carteret, NJ		\$	W I	0 4	0 1	1W-	16				
LAB NAME	Chemicals - Carteret, No		!_									
NJPOES NO. NJO 0 2 6 0 7 7	WELL PERMIT NO. YR.	MPLE DATE   MO.   DAY	N	هد	4	RT.	~°		ļ	w	2.9 2.9	JSE
	SUBMIT WITH SIGNED T-V	CWX-014										
Sampling Months		· <u></u>										
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	Specific Conductance			I	T		T	Ī	T	$\overline{\Box}$	$\top$	T
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	Floating Product			$\perp$			$\Box$				F	工
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ALUE CODING RULES AND EMARK CODES ON REVERSE			29 42 33 64			11 44 39 72	4; 40					10 1 33 3 44 5 73 1

# NEW JEHSEY DEFARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

# MONITORING REPORT - TRANSMITTAL SHEET

NIPOES NO.

REPORTING PERIOD .

YR. #0, Y:

0:01216101717

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PERMITTEE:	Mnocal Chemical				
	Address 1345 North Meacham	Road			
	Schaumburg, IL	60196			
FACILITY:	NameUnocal Chemicals Div				
	Carteret	(County	n Middlesex		
	Telephone <u>( 201 ) 541- 4224</u>				
FORMS ATTAC	HED (Indicate Quantity of Each)	OPER	ATES EXCEPTIONS	YES	Na
T-VWX-00	77-VWX-008 T-VWX-009	DYET	ESTORG		<b>₹</b> □
SLUDGE REPORT	S - INDUSTRIAL	TEMPS	DRARY EYPASSING		
T-VWX-01	0A T-VWX-010B	DISING	ECTION INTERRUPTION		$\boxtimes$
-		MORTI	DRONG MALFUNCTIONS		$\alpha$
T-VWX-01		ZTINU RBHTO	out of operation		<b>X</b>
GROUNDWATER F	A.B) 1 VWX-016 1 VWX-017	1	essy "Yes" on reverse side resprienze space.)		
NPDES DISCHARG	E MONITORING REPORT 1 3320-1		The "Hows Attended at Pi of this sheet must also be ca		te
AUTHENTICATION	ON - I certify under penalty of law the information submitted in this do of those individuals immediately submitted information is true, ac penalties for submitting false info	cument and all responsible for curate and com	attachments and that, b r obtaining the informati कांट्रंट. I am aware that	pased on ion, I bel there are	my inquilieve the
LICENSED OPER	ATOR		RECUTIVE OFFICER or	E	
Name (Printed)		Name (Arieses)	Daryl W. Dierweck	nter	
Grade & Registry N	No	Title (Prinsed)	Affairs		<b></b>
Signature		Signature			<del></del>
Daze		Does	March 21, 1989		

ERATING EXCEP	TIONS DETAILED					
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# HOURS ATTENDED AT PLANT

Month Year 1

Day of Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Licensed Operator					Ī	1	Ī									
Others																
Day of Month	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Licensed Operator																
Others																

PLEASE TYPE OR PRINT WITH BALLPOINT JEN

# W JERSEY DEPARTMENT OF WAVERUNDED YESEL W COLOTOSTORY OF WATER RESOURCES

# WATER QUALITY MANAGEMENT ELEMENT

# GRU 10 WATER ANALYSIS - MONITORING WELL REPORT

GRC OWATER ANALYSIS - MONITORING WELL REPORT

FACILITY NAME Unocal (	Cheminal Carteret NJ		SW IO NO MW-	17
LAB NAME	tories, Wappingers Falls, NY			
MAINCO CODOT O	,	SOATE		
NJPOES NO.		40.   DAY	NJ LAB CERT. NO.	WCM USE
b nadyaq	4	207	7 3 4 6 0	
1 4	• • • • • • • • • • • • • • • • • • • •			
THE SCHEDULE INDICATED BE	OT 81818 D MORE CEVESSED SE CT 21 WO.	0  8  9  2   NO. YE.		
	SUBMIT WITH SIGNED T-VWX	-014		
Sampling months				) = <
Feb. Mer. May June Aug. Sept.	ANALYSIS	TIMU	PARAMETER	VALUE
MIMIMIMI	Elevation of top of well casing with cap off (as specified in well completion report)	feet MSL: to nearest .01		9 2 3
MINIMI	Elevation of original ground level	feet MSL:		
MINININI	(as specified in well completion report)	to nearest .01	+	9.63
$X \mid X \mid X \mid X \mid X$	Depth to water table from top of casing prior to sampling with cap off	feet: to nearest .01	8 2 5 4 6	5.06
MINIMIMI	Depth to water table from original ground level prior to sampling	feet: to nearest .01	7 2 0 1 9	5.46
	Arsenic, Dissolved	UG/L as As	01101010	
	Barium, Dissolved	UG/L as 3a	011005	
	Biochemical Oxygen Demand - 5 Day	MG/L	003110	
	Cadmium, Dissolved	UG/L as Cd	0 1 0 2 5	
MIXIXIXI	Chloride, Dissalved	UG/L as CI	8 2 2 9 5	256400
	Chromium, Dissolved	UG/L as Cr	011030	
	Chromium, Dissolved, Hexavalent	UG/L as Cr	0 1 2 2 0	
	Chemical Oxygen Demand (COO), Dissolved	MG/L	0 0 3 4 1	
	Caliform Group	N/100 ML	7 4 0 5 6	
	Calar	Pt - Ca	0000180	
	Cooper, Dissalved	UG/L as Cu	011040	
	Cyanide, Total	MG/L as CN	0 0 7 2 0 1	
	Endrin, Total	UG/L	3 9 3 9 6 1	
	Fluoride, Dissolved	MG/L as F	001915101	1 1 1 1 1
	Grass Alona, Dissaived	Pc/L	0115031	
	Gross Beta, Dimpived	Pc/L	0 3 5 0 3	
	Hardness, Total as CaCO <sub>3</sub>	MG/L	0 0 9 0 0 1	1 1 1 1 1
	Iron, Dissalved	UG/L as Fe	0 1 0 4 6	
	Lead, Dissolved	UG/L 45 25	0 1 0 4 9	
	Lindane, Total	UG/L	3 9 7 8 2	
	Manganese, Dissolved	UG/L	0 1 0 5 6 1	
	Mercury, Dissalved	UG/L	7   1   a   9   0	
VALUE CODING RULES AND REMARK CODES ON REVERS			29 23 24 42 46 47 55 59 50 56 72 73	40 4. 33 34 66 57 79 40

# NEW JERREY DEPARTMENT OF ENVIRONMENTAL PROTECTION ZEDRUCZER RETAW RO NOIZIVIO

### THEMELE THEMEDANAMENT ELEMENT

Unocal Chemicals - Carteret, NJ											S	·	o 	.vc	). 	M	W-	- 1	7_					
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									SUBMIT WITH SIGNED T-YWX	·014														
	ىد	MPL	ING M	10N	THS																			
Feb.	ž.	A P.	- 12 A	¥	Z .	Ď.	N S	Dec.	ANALYSIS	TINU	1	PA	R.	LM	ΕT	ER				VA	LUI	•		
	T	T	11	Ī	П			Π	Methaxychlar, Tatal	UG/L	:	3	9	4	18	10	T	T	T	T	T	T	T	T
	1	1	11	T	П			Ī	Methylene Blue Active Substances	MG/L	1:	1	8	2	6	10	1	T	1	T	1	Ţ	T	Ť
	T	T	П					1	Nitrogen, Ammonia, Dissolved NH <sub>3</sub> + NH <sub>4</sub> as N	MG/L as N	10	ī	0	6	lo	8	T	T	1	T	Ī	T	Ī	Ť
11	T	1	$\overline{\Box}$	T				Ī	Nitragen, Nitrate Dissolved	MG/L as N	c	1	0	6	1	:8	T	T	T	1	Ī	1	T	Ť
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11					1	Ī			Phenois, Total Recoverable	UG/L	3	T	2	7	3	Ig	T	Ţ	Ī	T	Ţ	!	Ţ	Ī
11	$\Box$	1			T	I	- 1		Radium 225, Dissolved	PerL	0	T	9	5	0	3	Γ	T	Ī	Ī	T	Ī	1	Ī
						Ī			Radium 229, Dissolved	Pe/L	8	I	iŢ	3	5	6	T	T	1	T	Π		i	Γ
TT	Ī				1	Ī	1		Selenium, Dissalved	UG/L	0	1	ij	1	1	5	Γ	Ι		T			Ī	Ī
11	T		1	П		Ī			Silver, Dissalved	UG/L	0	İ	1	<b>a</b> }	7	5	Γ	!	Ī		1	I		Γ
	1	$\overline{\Box}$		Π	-		-		Sodium, Dissalved	MG/L	0	10	Ţ	9 ;	3	10		ī	1	Π	-			Ī
TI	ΙX	1			1	T	1		Sulfare, Dissolved (as SO <sub>4</sub> )	MG/L	0	l c	i	9	4	, 6			ļ		Ī			
<u>4 1</u>	١X	1	ΙX	1	$\neg x$	1	1		Total Dissolved Solids (TOS)	50M	7	C	1:	3 ¦	0	a			ļ	1	7	2	6	
11	T		11	$\overline{}$	Ī	Ī			Total Organic Carbon (TOC)	PPM	a	O	10	5 (	8	0								_
11	T		11	ī	T	T	T		Total Orçanic Halogen (TOX)	UG/L	7	0	1:	3	5	3		$\overline{}$				i		
П	1	11		1	}	Ī	T	$\exists$	Toxionene	UG/L	7	_	_	_	_	0						i		
11	T	Π	TI			T	1	1	Turbidity	NTU	0	0	10	) ļ	7 !	5					1	į	$\Box$	
11	X		I j	Ī	ļ	I	Ī	T	Zinc, Dissalved	UG/L	0	1	10	) :	9 i	0		1				į	ī	
11	1	П	11	1	T	Î	T	1	2, 4—0, Total	UG/L	3	9	13	ıΙ	7!	0			Ì	-	١	1		
	T		Ιİ	Ī		Ī	T	7	2, 4, 5—17, Total	UG/L	3	9	0	1   .	4	5	-	1		-		-	一	
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### WATER CUALITY MANAGEMENT ELEMENT

### GROUND WATER ANALYSIS - VOLATILE ORGANICS REPORT

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# NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES

WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

PLEASE TYPE OR PRINT MITH BALLPOINT PEN											
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# GROUND WATER ANALYSIS - MONITORING WELL REPORT

ACID, BASE/NEUTRAL ORGANIC COMPOUNDS

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REMARK CODES ON REVERSE

#### NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION DIVISION OF WATER RESOURCES WATER QUALITY MANAGEMENT ELEMENT

# GROUND WATER ANALYSIS - MONITORING WELL REPORT

please type or printwith gallpoint pen FACILITY NAME Unocal Chemicals - Carteret, NJ SW ID NO MW-17 LAB NAME NANCO Laboratories - Wappingers Falls, NY SAMPLE DATE NJPOES NO. WELL PERMIT NO. YR. | MO. | DAY NJ LAB CERT, NO. WCM USE NJ0 0 2 6 0 7 7 Ų 8 9 0 2 0 7 THE SCHEDULE INDICATED SELOW IS TO SE DESERVED FROM 018818 TO 018912 SUBMIT WITH SIGNED T. VWX-014 SAMPLING MONTHS ě ANALYSIS UNITS PARAMETER VALUE Specific Conductance 1 2 0 7 mhos/cm Floating Product X X X inches 0 Total Xvlenes ug/l 29 ! ١ 29 42 55 68 33 14 46 47 59 60 72 73 10 41 33 54 44 47 77 50 VALUE CODING RULES AND

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REFERENCE NO. 11

FINAL REPORT
INITIAL SITE ASSESSMENT
UNION CHEMICALS SITE
CARTERET, NEW JERSEY

Prepared for:

UNION CHEMICALS DIVISION
PETRO CHEMICAL GROUP
UNION OIL COMPANY OF CALIFORNIA
SCHAUMBURG, ILLINOIS

NOVEMBER 25, 1985 PROJECT NO. 671030

Prepared by:

IT CORPORATION
PITTSBURGH, PENNSYLVANIA

#### DRAFT REPORT

# INITIAL SITE ASSESSMENT UNION CHEMICALS SITE CARTERET, NEW JERSEY

#### 1.0 INTRODUCTION

IT Corporation (IT) was retained by Union Chemicals Division of Union Oil Company of California (Union Chemicals) to conduct a site assessment at their facility in Carteret, New Jersey (Figure 1). This site assessment followed Union Chemicals' request to IT in June 1985 for emergency response action to control the seepage of organic phase contaminants (product) into Noes Creek. The Union Chemicals site requires hydrogeologic and chemical data to both assess the existing in situ conditions at the site and to permit consideration of some remedial action alternatives designed to prevent further product seepage into Noes Creek. The objectives of this investigation are to characterize the following:

- o Unconsolidated materials underlying the site
- o Site hydrogeology, including the ground water flow direction and rate
- o Extent and depth of existing subsurface contamination.

A preliminary site investigation was conducted during the emergency response action. This work entailed the excavation of five test pits and the collection of soil and water samples for chemical analysis. The information derived from this initial task was used to establish guidelines for the sampling and analysis program conducted as part of the site assessment.

This 4.4-acre (estimated) site was purchased from the Benjamin Moore Company in 1962 and current operations were started in 1963. The facility has been primarily used for bulk storage and repackaging since that time; however, from 1969 to 1984, anhydrous ammonia was processed to ammonia.

Approximately 125 different products are handled at the facility, mostly solvents. The general categories of chemicals include:

- o Aromatic hydrocarbons
- o Aliphatic hydrocarbons
- o Petrochemicals
  - Alcohol
  - Chlorinated solvents
  - Esters
  - Glycol
  - Glycol ether
  - Glycol ether esters
  - Ketones
  - Surfactants
  - Plasticizers
  - Silicones.

The site includes a packaging facility in the northern portion of the property, a driveway area and parking lot with a tank truck loading terminal, and an oil/water separator unit about 40 feet east of the terminal. The property is bounded by Noes Creek to the south, New Jersey Branch railroad tracks to the west, Roosevelt Avenue to the east, and the now or former Wheeler Condenser and Engineering Company to the north. An additional railroad track spur extends from the southwest to the northeast through the facility.

#### 2.0 FIELD INVESTIGATION

### 2.1 EMERGENCY RESPONSE FIELD ACTIVITIES

Union Chemicals requested emergency response assistance on June 26, 1985 to contain product entering Noes Creek from a seep (Seep 1) south of the plant area (Figure 2). IT responded to their request to contain and collect seepage by placing a number of absorbent booms, both up— and downstream, across the creek, placing absorbent packs into sumps hand dug at the seep, and by excavating a suspect drain pipe found at the point of the seep. The excavation continued from the original point of the seep to just north of the concrete curb where a large pit was excavated. Product was observed seeping into this pit at several locations. A vacuum truck was used to collect the product and associated contaminated water which was then pumped into Union Chemicals storage tanks on site. Soil and water samples were collected from the area of the seep and analyzed for xylene, toluene, and benzene (Tables 1 and 2). A second seep was observed during these field activities approximately 60 feet east of the first seep (Figure 2). A sump was dug at the point of this seep

and packed with absorbent material. The second seep prompted additional investigation to better define the existing problem.

Four test pits were excavated along the southern perimeter curb of the parking lot and driveway (Figure 2). During excavation of Test Pits 1, 2, and 3, product was observed seeping from the subsurface soil walls. One composite soil sample was collected from each of the four pits. Samples from Test Pits 2 and 4 were analyzed for volatile organics compounds (Table 2). A water sample was also collected from the bottom of the vacuum truck (Table 1). Soil classifications for these pits are presented in Appendix A.

The results of analyses from soil and water samples collected during the emergency response and additional investigation activities were used to design the work plan for the site assessment described in the following sections of this report.

# 2.2 DRILLING AND SOIL SAMPLING

Thirteen six-inch-outside-diameter soil borings were drilled to selected depths through surface fill and into natural subsurface soils (Figure 2). Soil samples were collected continuously from the borings using a two-inchoutside-diameter split-barrel sampler which was decontaminated between samples using detergent followed by clean rinse water. The sampler was driven ahead of the augers by a 140-pound hammer dropped 30 inches to provide Standard Penetration Test data (American Society for Testing and Materials [ASTM] Procedure D1586). Soil sample composites were collected from each two-foot interval starting at the ground surface. The soil samples were placed in clean, 500-milliliter, sealed amber glass jars. Two. 40-milliliter volatile organic analysis (VOA) vials were also collected for each sample. Head space measurements for volatile organics were made from the jars with an organic vapor analyzer (OVA) to assist in characterizing soil contaminant levels (Table 3). All soil samples were shipped with appropriate chain-of-custody forms to the IT laboratory in Export, Pennsylvania for analysis and archiving. A log describing both the visual classification of the soils and drilling conditions was prepared by the IT field geologist (Appendix A). Drill cuttings and other wastes were drummed upon completion of each hole and properly disposed of later with other wastes derived from the initial emergency response activities at the Waste Conversion landfill.

# 2.3 MONITORING WELL INSTALLATION AND DEVELOPMENT

Monitoring wells were installed in 12 of the borings to allow ground water samples to be collected for chemical analysis and to provide water level information necessary to assess the direction and rate of ground water flow. The wells were constructed of two-inch-inside-diameter Schedule 40 stainless steel pipe with flush threads and 0.010-inch slotted stainless steel screens. A filter pack of coarse silica sand was placed in the annulus around each well screen and a bentonite seal was installed above the filter pack to impede the infiltration of surface water into the well. The remaining annulus between the borings and riser pipes was then grouted to ground surface with a mixture of cement and bentonite. A locking cap was installed on the riser pipe and eight-inch steel lamp hole covers were cemented in place around the riser pipe and set level with the ground surface. Well completion diagrams are presented in Appendix B.

The wells were developed by pumping with a diaphragm pump and flushing to remove fines from the area around the sensing zone to enhance communication between the water-bearing zone and the well. All water collected from the wells was placed in drums and later transferred to the Union Chemicals on-site storage tanks. All downhole well completion equipment was decontaminated between holes with hexane washes and distilled water rinses. The decontaminating fluids were collected and placed in the Union Chemicals on-site storage tanks.

# 2.4 MONITORING WELL ELEVATION AND LOCATION SURVEY

A survey was conducted of the installed monitoring wells by Goodman, Allgair, and Scott, a local, registered surveyor, to provide both vertical and horizon-tal control for water levels, samples, and geologic data. The Union Chemicals facility itself is surveyed horizontally to the New Jersey State Plane Coordinate System and vertically to the U.S. Geologic Survey elevations. Well locations and pertinent elevations are shown in Figure 2 and Table 4, respectively.

### 2.5 WATER LEVEL MEASUREMENT

Measurements of ground water levels in the monitoring wells were taken on three different dates and at five different times (Table 5). The water levels

were obtained at varying times in an attempt to define ground water gradients at the site under varying tidal conditions. It was concluded, however, that proper evaluation of the tidal influence on the site ground water gradient would require installation and operation of several continuous water level recorders for a period of at least two weeks.

# 2.6 GROUND WATER SAMPLING AND ANALYSIS

Water samples were collected from each of the monitoring wells using a 1.05inch-outside-diameter point source bailer. The samples were collected in order from the cleanest wells to those with the greatest accumulation of product. The sampling method was designed to determine whether or not volatile organic contaminants were stratified in the aquifer. Samples were collected separately from the top and bottom of the water column in Wells 5, 6, 8, 9, 10, and 11. Only the top of the water column was sampled in the remaining wells. The monitoring wells were not purged immediately prior to collecting samples to avoid disturbing any stratification of dissolved contaminants in the aquifer or the formation of free-phase product layers. Freephase product was observed in Monitoring Wells 5, 6, and 8 at the top of the ground water table. Sample temperature, pH, and specific conductance were measured and recorded for each sample in the field. Ground water samples were placed in appropriate sealed containers with appropriate chemical preservatives and cooled to wet ice temperature (4 degrees Celsius) for delivery to the IT analytical laboratory. Chain-of-custody forms were completed and shipped with the samples. The bailer was decontaminated between wells with hexane and distilled water which was collected and placed in the Union Chemicals on-site storage tanks.

All samples were analyzed for volatile organic compounds. Samples from Wells 1, 5, 8, and 12 were analyzed for chloride, sulfate, and alkalinity. The results of all analyses are presented in Table 6.

# 2.7 HYDRAULIC CONDUCTIVITY TESTING

In situ rising head permeability tests were conducted in Monitoring Wells 1, 4, 6, 7, and 12 following ground water sampling to determine well sensitivity (degree of communication between the well and the water-bearing zone) and the hydraulic conductivity of the water-bearing zone. The tests were conducted by

lowering the water level in the well below the ground water table and measuring the subsequent rise in water level as a function of time. The results of the permeability testing are presented in Table 7.

# 2.8 STREAM SEDIMENT SAMPLING

Two sediment samples were collected from Noes Creek (a low gradient tidally influenced stream); one from sediments upstream of the plant and the second from sediments downstream of the plant (Figure 2). The purpose of collecting these samples was to provide a preliminary determination of the plant's impact on Noes Creek sediments. The samples were collected with a hand trowel at the surface of the stream bottom sediments. Samples were placed in clean, amber glass jars and shipped to the IT laboratory for analysis. Results of the analysis are presented in Table 8.

#### 3.0 RESULTS OF INVESTIGATION

### 3.1 SITE GEOLOGY AND HYDROGEOLOGY

The Union Chemicals facility is constructed on relatively level fill material emplaced on irregular, unconsolidated sedimentary deposits. Cross sections were constructed from the borings logs and are presented in Figures 3, 4, and 5. The locations and orientations of the sections are shown in Figure 2.

Fill deposits range in thickness from zero to at least 15 feet beneath the site and are composed of fine to coarse sands with some gravels, clay, bricks, concrete, metal, glass, and slag. Beneath the fill are irregular deposits of sands, clays, silty clays, silt, and peat. It appears that older sand and clay deposits have been partially eroded and the depressions filled in with younger deposits of peat, clays, and sands. This reworking of sediments was probably the result of meandering and ensizing by Noes Creek.

Ground water elevation data were collected at five different times and tidal stages (Table 5). The data show fluctuating water levels which may be associated with tidal changes. The total change in ground water level and lag time at each well due to tidal influence cannot be determined from the present data base. It may be necessary to install and operate several continuous ground water level recorders for a short time period to obtain the data required for evaluation of remedial action alternatives.

Generally, the ground water flows from north to south across the site (Figure 6). The water table contours were developed from the average of the last four water level measurements, excluding deeper Wells MW-7 and MW-2.

Water levels in two well groups, MW-1 and MW-2 and MW-6 and MW-7, show a downward ground water gradient in the sediments. The gradient is slight but consistent at these two sites. Actual vertical gradients may be greater beneath the site; the measured magnitude is likely reduced from actual conditions by the size of the sensing zone established by the long length of screen in the wells.

Permeability test results indicate that the fill, sand, and clay deposits have low to moderate hydraulic conductivities (Table 7).

Assuming an average ground water gradient of 5 feet/330 feet, an average hydraulic conductivity of  $3 \times 10^{-5}$  feet per second ( $9 \times 10^{-4}$  centimeter per second), and a porosity of 0.4, the average ground water velocity was calculated to be about  $1 \times 10^{-6}$  feet per second, or about 32 feet per year. This value was calculated using the following equation:

$$V = \frac{ki}{A}$$

where

k = average hydraulic conductivity.

i = average horizontal ground water gradient perpendicular to the direction of ground water flow, and

0 = assumed representative porosity.

# 3.2 ANALYTICAL RESULTS

Elevated concentrations of volatile organics were detected in water and soil samples during the initial emergency response program (Tables 1 and 2). Additionally, free product was observed flowing into Test Pits 1 through 3 and at the water table in Monitoring Wells 5, 6, and 8. Water samples collected from seeps contained 8,200 parts per billion (ppb) benzene, 7,700 ppb toluene, and 100,000 ppb total xylenes. Soil samples collected from the area adjacent to the seep had a benzene concentration of 200 ppb and total xylenes of 440 ppb.

Table 2 also indicates the levels of volatile organics which were detected in soil samples from Test Pits 2 and 4. Test Pit 2 evidenced higher concentrations of all parameters analyzed than Test Pit 4, with the exception of ethylban ene and total xylenes. The Test Pit 2 soil sample contained significant oncentrations of:

o Chlorobenzene
o Methylene chloride
o Tetrachloroethylene
o 1,1,1-trichloroethane
o Acetone
o Total xylenes.

The Test Pit 4 soil sample contained significant concentrations of chlorobenzene and total xylenes.

During the drilling operations, head space measurements of volatile organics were conducted on soil samples which had been placed in glass jars. The results of the measurements indicate that organic materials are present throughout the sampled soil columns (Table 3). The type of OVA used for these determinations was of the ionization type so that methane gas, if present, did not influence the readings.

The ground water collected from the 12 monitoring wells was analyzed for all volatile priority pollutants and selected volatile nonpriority pollutants. Table 6 is a summary of pollutants detected in the water samples. The significant contaminants appearing on this list which have the potential for the greatest health risk are:

o Benzene
o Chlorobenzene
o Methylene chloride
o Tetrachloroethylene
o Trans-1,2-dichloroethylene
o 1,1,1-trichloroethane
o Trichloroethylene.

Significant (greater than 100 ppb) concentrations of these contaminants were found in Monitoring Wells 4 through 11.

Volatile organics were not detected in the sediment samples collected from Noes Creek.

# 4.0 QUALITATIVE RISK ASSESSMENT

### 4.1 INTRODUCTION

A hydrogeologic investigation of the Union Chemicals site located in Carteret, New Jersey has indicated the presence of several volatile organic chemicals in the ground water beneath the facility. This qualitative risk assessment will provide a preliminary appraisal of the health risks and environmental impacts associated with exposure to those chemicals in site-specific circumstances.

The fundamental concept of the risk assessment stipulates the requirement of a hazard and an exposure to that hazard before a health risk or environmental impact can occur. A completed exposure pathway is inferred, which includes three necessary components: (1) a source—the presence of contaminants having known toxicological characteristics; (2) an exposure pathway—actual or potential pathways that are complete; and (3) receptors—human and environmental receptors in the exposure paths. The hydrogeologic study has established the presence of the hazardous constituents and provides preliminary data to evaluate the potential exposure pathways.

High levels of monocyclic aromatic hydrocarbons (benzene, chlorobenzene, ethylbenzene, toluene, and xylene) and halogenated aliphatic hydrocarbons (tetrachloroethylene, 1,1,1-trichloroethane, and vinyl chloride) were detected in site ground water and surface seepage samples. A nonaqueous phase liquid (NAPL) flow condition, evidenced by the presence of a product layer above the aqueous fraction of the seeps and ground water samples, was observed during the emergency response and hydrogeologic investigation phases of this project.

Based on the geographical and topographical distribution of potential human receptors and environmental biota, a preliminary estimate would indicate a low potential for human exposure and a high possibility of impacts on environmental biota, to the extent they are present in Noes Creek and the Arthur Kill.

# 4.2 CONTAMINATION CHARACTERIZATION

The contamination pattern of volatile organic constituents found on site can be characterized by the presence (or absence) and concentrations of selected indicator chemicals in the individual environmental media samples and by evaluation of the spatial distribution of contaminants.

Volatile organic contamination of ground water was chosen as the primary site investigation focus due to the following:

o The bulk of the materials handled at the facility and the materials known to have been released in the past or detected in ground water during the emergency response phase of the project are volatile organic compounds.

o Volatile organic compounds are generally highly mobile in soils due to high volatility (as indicated by vapor pressure), have high water solubility, and low capacity for soil adsorption (soil adsorption coefficient); therefore, permanent soil and sediment contamination by volatile organics should be minimal as compared to current levels of ground water contamination.

# 4.2.1 Probable Contaminant Source

High concentrations of volatile organic chemicals were found in the ground water and seeps (aqueous and nonaqueous fractions) collected at the site. The observed pattern of contamination and the resulting hypothesized sources depend to some extent on the placement of the monitoring well. This dependence results from the necessity to infer contamination patterns between the monitoring wells.

It appears that past spills and leakage has occurred from the tank farm located in the northwest section of the site. Monitoring Well 12 is an on-site upgradient well that has some utility as the background descriptor. Monitoring Wells 1 to 3 may also be monitoring background water quality, or are located outside of the contaminant plume. The ground water in these wells does not appear to be impacted at the present time. Major chemical constituents in the contaminated ground water plume emanating from the tank area are monocyclic aromatic hydrocarbons (MAHs). Indicator constituents in this category are benzene, chlorobenzene, ethylbenzene, toluene, and xylene.

Halogenated aliphatic hydrocarbon (HAHs) display a different distribution pattern among the analyzed samples and the location of the sampling points. They appear to have emanated from the tank farm in the center of the Union Chemicals facility. This is based on the absence of these particular contaminants in the ground water in the vicinity of the northwest tank farm. The HAHs selected as indicator chemicals for this site are tetrachloroethylene (PCE), T,1,1-trichloroethane commonly known as methyl chloroform (MC), and vinyl chloride (VC) probably resulting from biodegradation of the PCE.

It must be emphasized that the above conclusions relating to the probable sources are based on limited background information and a small chemical analytical data base.

# 4.2.2 Characterization of Extent of Contamination

This description of the extent of contamination is intended to provide a framework for assessment of exposure to hazardous constituents migrating from the site. Since the chemical analytical data base is essentially limited to volatile organic contaminants detected in the ground water, the character of the other environmental media, i.e., ambient air (on and off site); soils (surficial and subsurface), in the unsaturated and saturated zone; surface water in Noes Creek and Arthur Kill; and creek sediments, cannot be directly evaluated. Appraisal of the likely extent of contamination of these environmental media is based on the limited background information and site investigation data available.

### Ambient Air

The quality of on-site ambient air is unknown. However, the presence of volatile organics at relatively high concentrations in the ground water, the very shallow unsaturated zone above the ground water table which potentially provides a link between the air and ground water through capillary action, and contaminated seeps on site would indicate some impact on ambient air quality.

Volatile organic constituents are volatilizing from ground water, possibly contaminated soils (actual levels are unknown; high OVA readings were observed during soil disturbance when excavating the test pits) and contaminated surface waters of Noes Creek. The ambient air levels of benzene are probably

elevated above background and could be at concentrations on the site that pose some risk upon exposure. All of the other contaminants, i.e., chlorobenzene, ethylbenzene, toluene, and xylene, will most likely also be elevated above background levels but are not expected to reach concentrations associated with health risks. None of the HAHs, although they will volatilize, are expected to be present above background levels. Vinyl chloride will evaporate readily at ambient temperatures, but detectable incremental elevations in concentrations are not likely due to the low levels detected in site ground water.

Undetermined semivolatile organics and inorganic constituents, if any, would not volatilize to the extent necessary to impact ambient air quality.

# Soils

There is only a very limited chemical analytical data base available to estimate the extent of soil contamination. Based on the behavior of chemicals in the environment, the list of chemical products handled at this facility, and the presence of a NAPL flow condition, the following limited characterization may be applicable to this site:

- o Presence and levels of volatile organic contaminants (found in the ground water) in the soils will be limited unless bulk dumping has occurred in the past or there is an ongoing contaminant release. Volatile organics are highly mobile in soils due to their ability to evaporate to air, high solubility in water, and low soil adsorption capability.
- o Phthalate esters, polycyclic aromatic hydrocarbons (PAHs), and halogenated ethers may be present at significant levels in the soils in the unsaturated and saturated zones. The reported product mix and presence of a nonaqueous fraction (which is mainly organic solvents) would enhance the mobility of these relatively immobile chemicals in the soil and water media. However, there are no data available to determine the validity of this premise.

#### Ground Water

There appears to be both vertical and horizontal migration of the volatile organic constituents found in the ground water. This is likely due to the behavior of these particular chemicals in the environment. Vertical stratification of contaminants in some of the wells is apparent; lower specific

gravity compounds were found in higher concentrations in samples taken from the top of the well. This may be due to gravity separation or could be due to a mixing of the NAPL solution in the upper sample.

The lighter MAHs appear to have migrated from the northwest tank area. The highest concentrations were found downgradient at this area in Monitoring Wells 6 and 8. Benzene and chlorobenzene were observed at the highest concentrations (benzene at 85,000 micrograms per liter [ $\mu$ g/ $\xi$ ] maximum; chlorobenzene at 230,000  $\mu$ g/ $\xi$  maximum) and with the highest frequency (15 positive detections in 16 samples). Only the MAHs (benzene, chlorobenzene, ethylbenzene, toluene, and xylene) and methyl chloroform have moved to the deeper part of the aquifer as indicated by the analytical results from the Monitoring Well 7 deep well sample.

The contaminant plume appears to be confined to a relatively limited area. Monitoring Wells 1 through 3 do not appear to be in the influence of the plume at this time.

Relative to potential exposure to contaminated ground water, it should be noted that:

- The dominant ground water flow direction is toward Noes Creek and Arthur Kill. This is away from the greatest concentration of human receptors located northwest of the site. Consequently, the potential for exposure to significant levels of volatile organic pollutants in ground water by ingestion is very low. This premise is valid whether the ground water is or is not being used for drinking purposes. There are, however, no known users of shallow ground water in the area of the site.
- o Because there are no available data regarding semivolatile organics that may be present in the ground water due to the NAPL conditions, the potential impacts due to ground water discharge to surface water cannot be evaluated.

### Surface Water

There is a very limited available data base to characterize the contamination of surface water, i.e., Noes Creek and Arthur Kill. Seeps and ground water accumulated in the test pits are defined as ground water for the estimation of

health risks and environmental impacts. Evaluation of surface water quality was not an objective of the first phase of the hydrogeological study.

A clear understanding of the environmental fate of the site contaminants is essential for estimating health and environmental impacts. The volatile organics in the ground water will be essentially volatilized at the surface water/ambient air interface. The most likely potential impacts on environmental and human receptors will be from migration of semivolatile organic pollutants in the nonaqueous fraction of contaminated ground water to both surface water and sediments. Semivolatiles that are solubilized in the nonaqueous phase could adsorb to colloidal particles in surface water and settle to the bottom in the sediments. There, they would be available to aquatic biota if biota are present. Some toxic constituents, i.e., PAHs, if they are present, could move up the food chain by bioaccumulation and biomagnification to result in significant potential exposure.

The extent of surface water contamination is unknown. Attenuation of volatile organic contaminants by evaporation and the unlikely possibility of impacted surface water being used as a potable water source (it may be brackish or sea water) may preclude exposure by human receptors. Transfer of volatile organics to ambient air is not expected to result in significant levels due to the great opportunities for attenuation by advection and dispersion in the open atmosphere.

#### 4.3 EXPOSURE PATHWAYS

An exposure pathway is the route a contaminant may take to reach a susceptible receptor. For an exposure pathway to be complete, three factors must be present: a source of contamination, a route of contaminant transport, and an exposure of an environmental or human receptor to the contaminants. The mode of exposure and its duration also influence the impacts. Modes of exposure are usually categorized as inhalation, ingestion, and dermal (direct contact). There may be indirect exposures by ingestion of contaminated foods and by dermal and inhalation during recreational use (wading, fishing, and boating) of surface waters. Exposure durations are separated into two main classes, i.e., acute, which is of short duration and frequency, and chronic, which implies long-term (months and years) and continuous or frequent exposure.

# 4.3.1 Ambient Air

All of the detected contaminants are volatile organic constituents; consequently, all will evaporate at the soil/air and surface water/air interface to result in incremental increases in levels above background. The only potential exposure to toxicologically significant levels of the most critical contaminant (benzene) will be on site. Advection and dispersion would attenuate vapor concentrations to safe levels at the nearest off-site human receptor locations.

# 4.3.2 Soils

# Surficial Soils

The relatively difficult access to the industrial area in which the site is located (the presence of a railroad track and perimeter fencing separating the residential area from this site) will minimize the trespass of children and third-party intruders. Consequently, only on-site personnel will be considered to be the potential receptors due to direct contact with or ingestion of contaminated surficial soils. Therefore, direct contact with contaminated surface soils is not considered to be a potential exposure path.

### Subsurface Soils

Exposure to contaminants that may be present in the deep soils by direct contact is not expected to be a viable exposure pathway. Deep soils may serve as a conduit to transport volatile organics, and potentially semivolatile organics mobilized in the NAPL, to ground water.

Migration of volatile organics from the unsaturated zone to ambient air will elevate ambient air concentrations, but significant concentrations are not expected on site and are very unlikely at any off-site receptor location.

# 4.3.3 Ground Water

Ingestion of contaminated ground water is not expected to be a critical exposure path at this site. All of the ground water beneath the site is flowing away from the closest cluster of homes (supplied by a city water system).

Ground water discharges from the site into Noes Creek very rapidly reach Arthur Kill. Both bodies of water are subject to salt water intrusion making local surface water an unavailable source of potable water for the nearby residents.

Indirect exposure to some contaminants, if the volatile organics are not attenuated, during recreational use of Arthur Kill is possible. However, the industrial character of the surrounding area and the presence of a large active landfill and marsh on the Staten Island side of the Kill would deter recreational use of the surface water in the impacted area.

### 4.3.4 Surface Water

Surface waters may be impacted. There are no available data to determine whether volatile organic contaminant attenuation is occurring. If semivolatile organic constituents are entering the Creek and Kill they would accumulate in the bottom sediment. Consequently, there could be some potential for uptake in the food chain with subsequent exposure of human receptors due to ingesting contaminated aquatic food. The volatile organics do not bioaccumulate to any great extent. The most likely exposure path would be associated with semivolatiles that may be mobilized in the NAPL and transported by ground water discharges and surface seeps to Noes Creek.

# 4.3.5 Environmental Impacts

The most toxic class of contaminants in the context of aquatic toxicity is the inorganic constituents. This does not appear to be a problem at this site. The low conductivity of the ground water samples is indicative of low dissolved solids and an absence of ionic activity in the water. Volatile organics will be attenuated due to evaporation of the surface water/air interface. In addition, most of them are not acutely or chronically toxic to aquatic biota at the expected surface water concentrations. The introduction of pollutants from the landfill that have high associated biological and chemical oxygen demand may affect the dissolved oxygen levels in the creek and Arthur Kill to result in adverse effects on the aquatic biota (if they are present).

### 4.4 RECEPTORS

The following potential human receptors may be present in the vicinity of the site:

o Users of ground water for drinking purposes - None known in the area surrounding the site

- O Users of surface water for recreational purposes Dermal exposure during swimming and boating (inadvertent dermal exposure) and inhalation of volatilized
  organics
- o Persons trespassing on site and coming in direct contact (dermal exposure) with contaminated soils and ground water (seeps) on site
- Persons coming in contact with contaminated sediment and surface soils that may have migrated off site in surface runoff
  - o Persons inhaling volatilized organic vapors that are mobilized by wind erosion
  - o Persons consuming contaminated aquatic food that has bioaccumulated and biomagnified contaminant levels.

# Environmental receptors include:

- Aquatic biota that are exposed to organic contaminants with associated bioaccumulation and biomagnification characteristics
- Surface waters that may be adversely affected to limit their use for any purpose
- Wetland and marsh ecologies that are very fragile and will be adversely altered by introduction of chemical contaminants.

The identification and characterization of the above receptors was not an objective of the first phase of this investigation. Based on the topographical and geographical character of the site and the surrounding area, as interpreted from the USGS map, the presence of the above receptors at locations where significant impacts may be possible is not a high probability at present or at some future time.

# 4.5 HAZARD IDENTIFICATION

The identification and characterization of hazards associated with the site is based on the presence and concentration of chemicals found. Consequently, this hazard characterization is based on volatile organic compounds detected in the ground water beneath the site.

The following criteria are used to select the indicator contaminants for the risk assessment:

- O Toxicity If the contaminant has associated biological health impacts, i.e., carcinogenicity or development effects, it should be included as a contaminant of concern. Acute and chronic systemic toxicity has an implied threshold level; consequently, other criteria must be used in conjunction with toxicity.
- o Concentration levels Constituents detected at high concentrations in the environmental media should be included if they are prevalent.
- o Prevalence is defined by the frequency of positive detections in the collected samples and the character of the contamination pattern.
- o Persistence in the environment.

Table 9 provides a summary of the pertinent factors for categorizing the detected contaminants.

Benzene, vinyl chloride, and PCE are classified as suspect animal or human carcinogens. They were found frequently, especially benzene, in the ground water samples at significant concentrations. Consequently, all were included as indicator contaminants.

Ethylbenzene, toluene, methyl chloroform, and xylene, which have exhibited systemic toxicity with associated thresholds, were detected frequently to indicate a high prevalence in the ground water. They were selected as indicator contaminants for the risk assessment.

Chlorobenzene was classified as an indicator chemical due to the very high concentrations found on site. Since it does not possess any toxicological properties, it was considered to be a precursor of benzene and xylene and was used to define the extent of contamination.

Although chloroethane was frequently detected in the ground water samples and the maximum concentration of 1,600 ug/1 was considered to be an anomaly (the next highest value was 67 ug/1) the concentrations are not considered to be significant. This evaluation is based on the low toxicity of this compound by

the ingestion route and its chemical nature, i.e., it is a gas at normal temperatures. 1,1-dichloroethane and 1,2-trans-dichloroethylene were also detected frequently. However, at the concentrations measured exposure is not likely to cause a health impact.

Ketones (acetone, 2-butanone [methylethyl ketone]) and styrene were found less frequently. However, at the reported concentrations, exposure is not expected to result in any adverse health impacts due to the relatively low systemic toxicity of these compounds.

# 4.6 EXPOSURE ASSESSMENT

As explained in the previous sections, there is no existing exposure of receptors to the site contaminants due to hydrological and geographical factors. Vapors and airborne particulates are not expected to reach off-site human receptors in signifianct conentrations. Additionally, the population in close proximity to the site is served by a municipal water system and the direction of contaminated ground water migration is directly away from the closest off-site human receptors. Thus, they are not located in potential exposure pathways. Ambient air and ground water contaminant concentrations will be reduced to insignificant levels by the time they reach the nearest downwind and downgradient human receptor.

If sensitive ecological systems are in the exposure pathway, i.e., marsh and wetland habitats, there could be some potential degradation or alteration of the biotic communities.

Presence or absence of environmentally persistent contaminants has not been established. The above exposure assessment is based only on the available chemical analytical data, hydrological data developed in this phase of the investigation, and an interpretation of the U.S. Geological Survey topographic map of the area.

# 4.7 RISK CHARACTERIZATION

Due to hydrological and topographical factors, and spatial distribution of possible receptors, the site does not appear to pose any health risks. There is some potential for environmental impacts on aquatic and terrestrial biota if fragile ecological habitats are located in the area.

TABLE 4
MONITORING WELL ELEVATIONS(a)

MONITORING WELL	TOP OF COULD	TOP OF INSIDE PIPE	BOTTOM OF WELL
MW-1	8.98	8.27	-1.02
MW=2	8.47	7.91	-21.53
MW-3	9.31	8.87	-4.69
MW-4	9.30	8.68	1.30
MW-5	9.16	8.90	1.16
MW-6	8.84	8.60 .	-7.16
MW-7	8.83	8.24	-23.17
MW-8	9.43	8.82	4.57
MW-9	10.40	9 <b>.89</b>	-4.60
MW-10	10.83	10.32	2.83
MW-11	11.25	10.70	3.25
MW-12	12.48	12.10	4.48

<sup>(</sup>a)Elevations in feet (msl).

GROUND WATER BLEVATIONS TABLE 5

# DATE/APPROXIMATE TIME

MONITORING WELL NO.

	9-17-85/07:50(a)	9-17-85/14:20(b)	10-7-85/10:00(c)	10-7-85/16:15(d)	10-15-85/12:30(e)
-	2.69	3,10	4.52	2.52	68.7
2	3.45	3,33	4.16	2.16	4.78
3	5.45	6.24	6.54	5.87	9:50
7	5.51	5.91	6.35	6.18	06.9
2	3.15	3.65	3.57	3.40	7,000
9	3.60	4.18	4.45	3.10	4.83
7	2.86	3.16	4.16	3.24	6.70
80	4.53	5.49	5.66	5.03	5.02
<b>O</b>	7.39	7.89	8.31	8.16	97.8
10	6.07	8.11	8.57	8.69	8.77
=	8.20	9.20	9.91	9.89	6.67
12	8.60	9.93	10.93	10.89	10.44

(a) ligh tide at Sandy Hook, NJ 9-17-85 was at 09:24. (e)Low tide at Sandy Hook, NJ 10-15-85 was at 14:38. (b)Low tide at Sandy Hook, NJ 9-17-85 was at 16:00. (c) High Lide at Sandy Hook, NJ 10-7-85 was at 13:11. (d)Low tide at Sandy Hook, NJ 10-7-85 was at 20:18.

Note: All elevations in feet (msl).

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Artigoria	1.1	î	22	7,700	2,500	49,000	45,000	120	17,0041	18,000	2,900	2, 100	1.70	3	240	240	,
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### TABLE 8 STREAM SEDIMENT ANALYSES SUMMARY

PARAMETER

SAMPLE IDENTIFICATION

Volatile Priority Pollutants

NC-D

NC-U

(ppb)

None Detected

Volatile Non Priority Pollutants

(ppb)

None Detected

Other Parameters

(ppm)

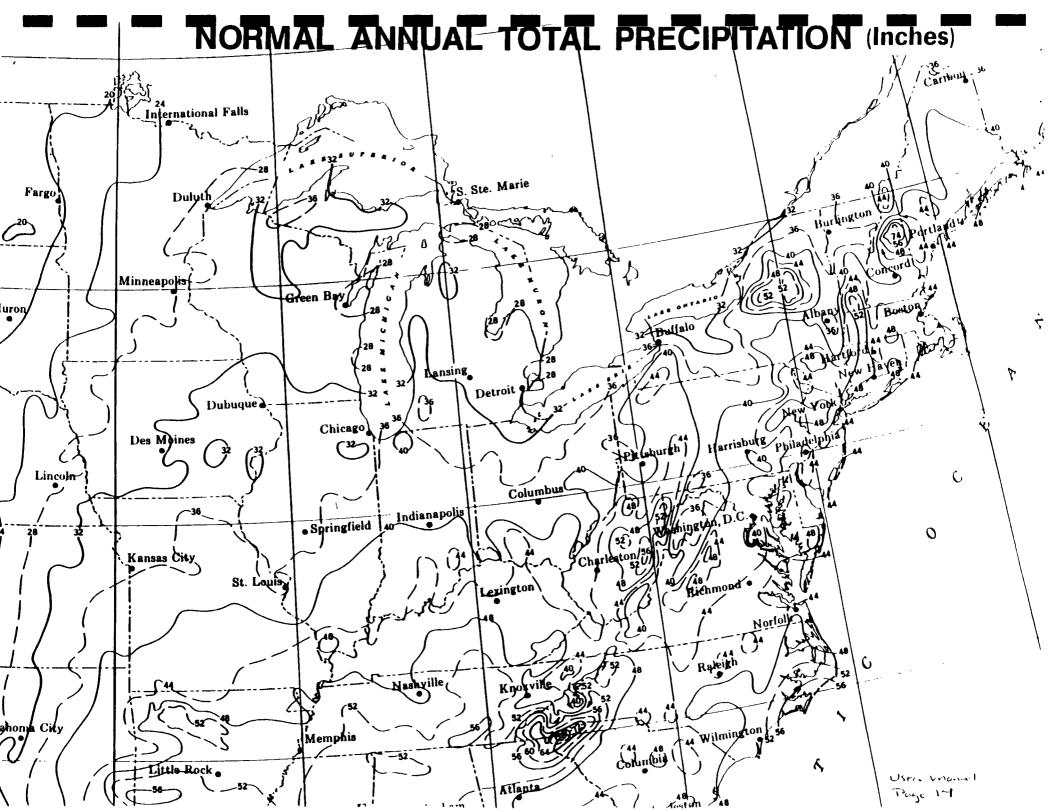
Total Organic Carbon Total Organic Halogen 3500 0.40/0.46 3300 0.74 REFERENCE NO. 12

## Uncontrolled Hazardous Waste Site Ranking System

A Users Manual (HW-10)

Originally Published in the July 16, 1982, Federal Register

United States Environmental Protection Agency



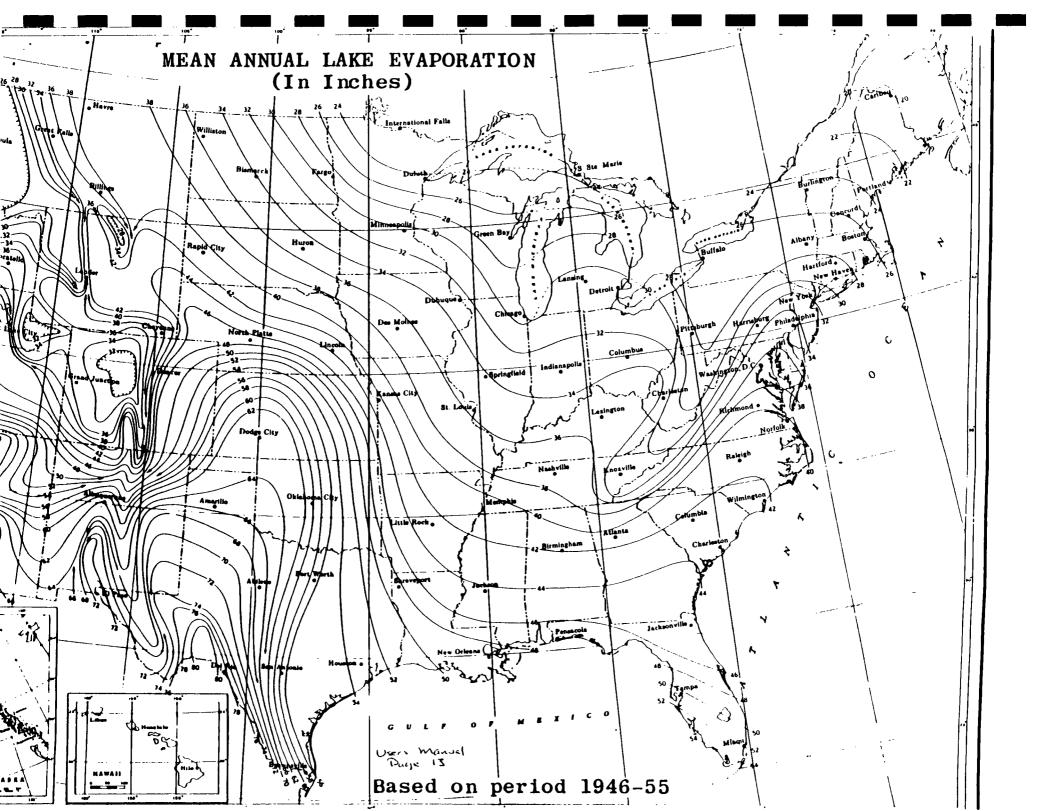


TABLE 2
PERMEABILITY OF GEOLOGIC MATERIALS\*

Type of Material	Approximate Range of Hydraulic Conductivity	Assigned Value
Clay, compact till, shale; unfractured metamorphic and igneous rocks	<10 <sup>-7</sup> cm/sec	0
Silt, loess, silty clays, silty loams, clay loams; less permeable limestone, dolomites, and sandstone; moderately permeable till	10 <sup>-5</sup> - 10 <sup>-7</sup> cm/sec	1
Fine sand and silty sand; sandy loams; loamy sands; moderately permeable limestone, dolomites, and sandstone (no karst); moderately fractured igneous and metamorphic rocks, some coarse till	10 <sup>-3</sup> - 10 <sup>-5</sup> cm/sec	2
Gravel, sand; highly fractured igneous and metamorphic rocks; permeable basalt and lavas; karst limestone and dolomite	>10 <sup>-3</sup> cm/sec	3

<sup>\*</sup>Derived from:

Porous Media, R.J.M. DeWest ed., Academic Press, New York, 1969

Freeze, R.A. and J.A. Cherry, Groundwater, Prentice-Hall, Inc., New York, 1979

### TABLE 3

### CONTAINMENT VALUE FOR GROUND WATER ROUTE

Assign containment a value of 0 if: (1) all the hazardous substances at the facility are underlain by an essentially non permeable surface (natural or artificial) and adequate leachate collection systems and diversion systems are present; or (2) there is no ground water in the vicinity. The value "0" does not indicate no risk. Eather, it indicates a significantly lower relative risk when compared with more serious sites on a national level. Otherwise, evaluate the containment for each of the different means of storage or disposal at the facility using the following guidance.

A. Surface Impoundment		C. files	
	Assigned Value	Assigned Value	
Sound run-on diversion structure, essentially non permeable liner (natural or artificial) compatible with the weste, and	0	Piles uncovered and waste stabilized; 0 or piles covered, waste unstabilized, and essentially non permeable liner	
adequate leachate collection system		Piles uncovered, waste unstablized, lenderstely permeable liner, and leachate	
Essentially non permeable compatible liner with no leachate collection system; or inadequate freeboard	•	collection system	
Potentially unsound run-on diversion	. 2	Piles uncovered, weste unstabilised, 2 moderately permeable liner, and no leachate collection system	
structure; or moderately permeable compatible liner		Files uncovered, waste unstablized, and no	
Unsound run-on diversion structure; no liner; or incompatible liner	3	liner D. Landfili	
B. Containers		Assigned Value	
	Assigned Value	Essentially non permeable liner, liner O compatible with waste, and adequate	
Containers sealed and in sound condition, adequate liner, and adequate leachate	0	leachate collection system	
collection system  Containers sealed and in sound condition,	ı	Essentially non permeable compatible liner, no leschete collection system, and landfill surface precludes ponding	
no liner or moderately permeable liner  Containers leaking, moderately permeable liner	2	Moderately permeable, compatible lines, and landfill 2 surface precludes ponding	
Containers leaking and no liner or incompatible liner	3	No liner or incompatible liner; moderately 3 permeable compatible liner; landfill surface encourages ponding; no run-on control	

more specific information is given in Tables 4 and 5.

Toxicity of each hazardous substance being evaluated is given a value using the rating scheme of Sax (Table 6) or the National Fire Protection Association (NFPA) (Table 7) and the following guidance:

Toxicity	Assigned Value
Sax level 0 or NFPA level 0	O
Sax level 1 or NFPA level 1	1
Sax level 2 or NFPA level 2	2
Sax level 3 or NFPA level 3 or 4	3

Table 4 presents values for some common compounds.

Hazardous waste quantity includes all hazardous substances at a facility (as received) except that with a containment value of 0.

Do not include amounts of contaminated soil or water; in such cases, the amount of contaminating hazardous substance may be estimated.

On occasion, it may be necessary to convert data to a common unit to combine them. In such cases, 1 ton = 1 cubic yard = 4 drums and for the purposes of converting bulk storage, 1 drum = 50 gallons. Assign a value as follows:

Tons/Cubic		Assigned
<u>Yards</u>	No. of Drums	<u>Value</u>
0	0	0
1-10	1-40	1
11-62	41-250	2
63-125	251-500	3
126-250	501-1000	4
251-625	1001-2500	5
626-1250	2501-5000	6
1251-2500	5001-10,000	7
>2500	>10,000	8

TABLE 4
WASTE CHARACTERISTICS VALUES
FOR SOME COMMON CHEMICALS

		_			
					*
CREDIT CALL/CONTROUND					,
Acetaldebyde	,	0	3	2	
Acetic Acid	3	0	2	1	
Acetone	2	0	3	0	
Aldrin	3	3	1	0	
Amonia, Anhydrous	3	٥	1	0	
Aniline	3	1	2	0	
Benzene	3	1	3	0	
Carbon Tetrachloride	3	3	0	0	!
Chlordane	3	3	00	0.	
Chlorobensene	2	2	3	0	
Chloroform	3	3	٥	0	
Cresol-0	3	1	2	0	
Cresol-H67	3	1	1	٥	
Cyclohexane	2	2	3	0	
Indria	3	3	1	0	
Sthyl Benzene	2	1	3	0	
Formaldahyda	3	0	2	0	
Formic Acid	3	0	2	0	
Bydrochloric Acid	3	0	0	0	
leopropyl Ether	3	1	3	1	1
Lindane	3	3	1	0	ļ
Nothane	1	1	3	0	
Nethyl Ethyl Estone	2	0	3	0	
Hethyl Parathion in Kylene Solution	3	gΔ	3	2	
Maphthalene	2	1	2	0	
Mitric Acid	3	0	٥	٥	
Parathies	3	oΔ	1	2	1
703	3	3	0▲	08	1
Petroleum, Karosems (Fuel Oil No. 1)	3	1	2	0	
Phenol	3	1	2	0	
Sulfuric Acid	,	0	0	2	
Toluene	2	1	3	0	1
Trichlorobenzene	2	3	1	0	
er-Trichloroethene	2	2	1	0	
Zylene	2	1	3	0	

<sup>&</sup>lt;sup>1</sup>Sax, W. I., <u>Desgerous Properties of Industrial Materials</u>, Van Mostrand Eheinhold Co., New York, 4th ed., 1975. The highest rating listed under each chemical is used.

<sup>&</sup>lt;sup>2</sup>JEB Associates, Inc., <u>Mathodology for Rating the Hazard Potential of Waste Disposal Sites</u>, May 5, 1980.

<sup>&</sup>lt;sup>3</sup>National Fire Protection Association, Mational Fire Codes, Vol. 13, No. 49, 1977.

Professional judgment based on information centained in the U.S. Coast Guard CMRIS Hazardous Chemical Data, 1978.

 $<sup>\</sup>Delta$  Professional judgment based on existing literature.

### TABLE 5

### PERSISTENCE (BIODEGRADABILITY) OF SOME ORGANIC COMPOUNDS\*

VAL	UE - 3 HIGHI	Y PERSISTENT CONTOUNDS
aldrin .		beptachior
benzopyrene		heptachlor apoxide
benzothiezole		1,2,3,4,5,7,7-heptachloromorbornes
benzothiophene		hexachlorobensene
beasyl butyl phthaiate		hexachioro-1,3-butadiene
bromoch lorobensene		hexachlorocyclohexane
bromoform butanel		hexachloroethene
bromophenyl phyntl ether		methyl beasothiasole
chlordane		pentachlorobiphenyl
chlorohydroxy benzepheno	D <b>e</b>	pent schlorophenol
bis-chloroisoprophyl ath	96	1,1,3,3-tetrachloroscetoge
n-chloronitrobensene		tetrachlorobiphenyl
DDE		thiomathylbensothiasole
DDT		trichlorobensene
dibromobenzane		trichlorobiphenyl
ilbutyl phthelete		trichlorofluoromethene
l, 4-dichlorobensene		2,4,6-trichlorophenol
itchlorodifluoroathane		triphonyl phosphate
lioldria		bronodichlorouethene
liethyl phthelete		bromoform
ii(2-athylhaxyl)phthalate	)	carbon tetrachloride
lihexyl phthalate		chloroform
li-isobutyl phthalate		chlorosochlorose thene
dimethyl phthalate		dibromodichlorosthans
,6-dinitro-2-aminophenol		tetrachloroethana
lipropyl phthelete		1,1,2-trichlorosthene

VALUE - 1 SONEWAL	AT PERSISTENT CONFOUNDS
acetylene dichloride behenic acid, methyl ester bensene bensene sulfonic acid butyl bensene butyl bromide a-caprolactam carbon-disulfide o-cresol decane 1,2-dichloroethane 1,2-dimethyl nephthelene 1,3-dimethyl nephthelene 1,4-dimethyl phemol dioctyl adipate n-dodecane ethyl bensene 2-athyl-n-bessene o-ethyltoluene leodecane isoprophyl bensene	limonane mathyl ester of lignoperic activathane 2-mathyl-5-ethyl-pyridine mathyl saphthelene mathyl palmitate mathyl phenyl carbinol mathyl stearate maphthelene monane octane octyl chloride pentane phenyl bensoate phthelic anhydride propylbensene l-terpissol toluene vinyl bensone mylene

· · · · · · · · · · · · · · · · · · ·	ALUE - 2 PERSISTENT COMPOUNDS
acenaphthylene	cis-2-ethyl-4-methyl-1,3-diomolene
atrasine	trans-2-athyl-4-mathyl-1,3-diozolace
(disthyl) atrasine	guelecol
barbital	2-bydroxyadiponitrile
borneol	isophorone
bromobenzene	indene
camphor	isoborneol
chlorobensene	isopropenyl-r-isopropyl bennene
1,2-bis-chlorosthony ath	ne 2-methoxy bisheavl
b-chlorosthyl methyl eth	
chloromethyl ather	methyl chloride
chloromethyl ethyl ether	methyl indene
3-chloropyridine	methylene chloride
di-t-butyl-p-bensoquinon	
dichloroethyl ather	Bitrobensene
dihyrocarvone	1,1,2-trichloroethylene
dimethyl sulfoxide	trimethyl-trioxo-hexabydro-triarine
2,6-distrotoluese	icement - crioxo-mexanydro-triarina

VALUE - 0 I	CONTERSISTENT CONFOUNDS
acetaldehyde scatic acid acetone scetophenone bensoic acid di-facbutyl carbinol docosane stcosane ethanol ethylamine hemndecane methanol	methyl bensoste 3-methyl butanol methyl athyl ketone 2-methylropanol octadacane pentadecane pentanol propanol propylanine tetradecane n-tridacane n-undecane

### TABLE 6

### SAX TOXICITY RATINGS

### 0 - No Toxicity\* (Rose)\*\*

This designation is given to materials which fall into one of the following categories:

- (a) Materials which cause no here under any conditions of normal use.
- (b) Meterials which produce toxic effects on humans only under the most unusual conditions or by everwhelming dosage.

### 1 - Slight Toxicity\* (Low)\*\*

- (a) Acute local. Meterials which on single exposures lasting seconds, minutes, or hours cauge only slight effects on the skin or mucuous membranes regardless of the extent of the exposure.
- (b) Acute systemic. Materials which can be absorbed into the body by inhelation, ingestion, or through the skin and which produce only slight effects following single exposures lasting seconds, minutes, or hours, or following ingestion of a single dose, regardless of the quantity absorbed or the extent of exposure.
- (c) Chronic local. Materials which on continuous or repeated exposures extending over periods of days, seaths, or years cause only slight and usually reversible here to the skin or succus membranes. The extent of exposure may be great or small.
- (d) Chronic systemic. Materials which can be absorbed into the body by inhalation, ingastion, or through the skin and which produce only slightly usually reversible effects extending over days, months, or years. The extent of the exposure may be great or small.

In general, those substances classified as having "slight toxicity" produce changes in the human body which are readily reversible and which will disappear following termination of emposure, either with or without medical treatment.

### 2 - Moderate Toxicity\* (Hod)\*\*

- (a) Acute local. Meterials which on single exposure lasting seconds, minutes, or hours cause moderate effects on the skin or mucous membranes. These effects may be the result of intense exposure for a matter or seconds or moderate exposure for a matter of hours.
- (b) Acule systemic. Nateriels which can be absorbed into the body by inhalation, ingestion, or through the skin and produce woderate effects following single exposures lesting seconds, minutes, or hours, or following ingestion of a single dome.
- (c) Chronic local. Materials which on continuous or repeated exposures extending over periods of days, months, or years cause moderate harm to the skin or mucous membranes.
- (d) Chronic systemic. Materials which can be absorbed into the body by inhalation, ingestion, or through the skin and which produce moderate effects following continuous or repeated exposures extending over periods of days, months, or years.

Those substances classified as having "moderate toxicity" produce irraversible as well as reversible changes in the human body. These changes are not of such asverty as to threaten life or to produce serious physical impairment.

### 3 - Severe Toxicity\* (High) \*\*

- (a) Acute local. Materials which on single emposure lasting seconds or minutes cause injury to skin or mucous membranes or sufficient severity to threaten life or to cause permanent physical impairment or disfigurement.
- (b) Acute systemic. Materials which can be absorbed into the body by inhalation, ingestion, or through the shin and which can cause injury of sufficient severity to threaten life following a single exposure lasting seconds, minutes, or hours, or following inguestion of a single doss.
- (c) Chanic local. Materials which on continuous or repeated exposures extending over periods of days, mouths, or years can cause injury to shin or mucous membranes of sufficient severity to threaten life or cause permenent impairment, which disfigurement, or irreversible change.
- (d) Chronic ayatemic. Materials which can be absorbed into the body by inhalation, ingestion or through the skin and which can cause death or serious physical impairment following continuous or repeated exposures to small amounts extending over periods of days, months, or years.
- \*Sax, N.I., <u>Dangerous Properties of Industrial Materials</u>, Van Nostrand Rheinhold Company, New York, 4th Edition, 1975.
- \*\*Sax, N.I., <u>Dangerous Properties of Industrial Materials</u>, Van Nostrand Rheinhold Company, New York, 5th Edition, 1979.

### 3.5 Targets

Ground water use indicates the nature of the use made of ground water drawn from the aquifer of concern within 3 miles of the hazardous substance, including the geographical extent of the measurable concentration in the aquifer. Assign a value using the following guidance:

Ground Water Use	Assigned Value
Unusable (e.g., extremely saline aquifer, extremely low yield, etc.)	0
Commercial, industrial or irrigation and another water source presently available; not used, but usable	1
Drinking water with municipal water from alternate unthreatened sources presently available (i.e., minimal hookup requirements); or commercial, industrial or irrigation with no other water source presently available	2
Drinking water; no municipal water from alternate unthreatened sources presently available	 3

Distance to nearest well and population served have been combined in the matrix below to better reflect the important relationship between the distance of a population from hazardous substances and the size of the population served by ground water that might be contaminated by those substances. To determine the overall value for this combined factor, score each individually as discussed below. Match the individual values assigned with the values in the matrix for the total score.

Value for Population	Value for Distance to Nearest Well				
Served	0	1	2.	3	4
0	0	0	0	0	0
1	0	4	6	8	10
2	0	8 .	12	16	20
3	0	12	18	24	30
Ž.	0	16	24	32	35
5	0	20	30	35	40

Distance to nearest well is measured from the hazardous substance (not the facility boundary) to the nearest well that draws water from the aquifer of concern. If the actual distance to the nearest well is unknown, use the distance between the hazardous substance and the nearest occupied building not served by a public water supply (e.g., a farmhouse). If a discontinuity in the aquifer occurs between the hazardous substance and all wells, give this factor a score of 0, except where it can be shown that the contaminant is likely to migrate beyond the discontinuity. Figure 6 illustrates how the distance should be measured. Assign a value using the following guidance:

Distance	Assigned Value	
>3 miles	0	
2 to 3 miles	1	
1 to 2 miles	2	
2001 feet to 1 mile	3	
< 2000 feet	4	

Population served by ground water is an indicator of the population at risk, which includes residents as well as others who would regularly use the water such as workers in factories or offices and students. Include employees in restaurants, motels, or campgrounds but exclude customers and travelers passing through the area in autos, buses, or trains. If aerial photography is used, and residents are known to use ground water, assume each dwelling unit has 3.8 residents. Where ground water is used for irrigation, convert to population by assuming 1.5 persons per acre of irrigated land. The well or wells of concern must be within three miles of the hazardous substances, including the area of known aquifer contamination, but the "population served" need not be. Likewise, people within three miles who do not use water from the aquifer of concern are not to be counted. Assign a value as follows:

Population	Assigned	Value
0	0	
1-100	i	
101-1,000	2	
1,001-3,000	3	
3,001-10,000	4	
>10,000	5	

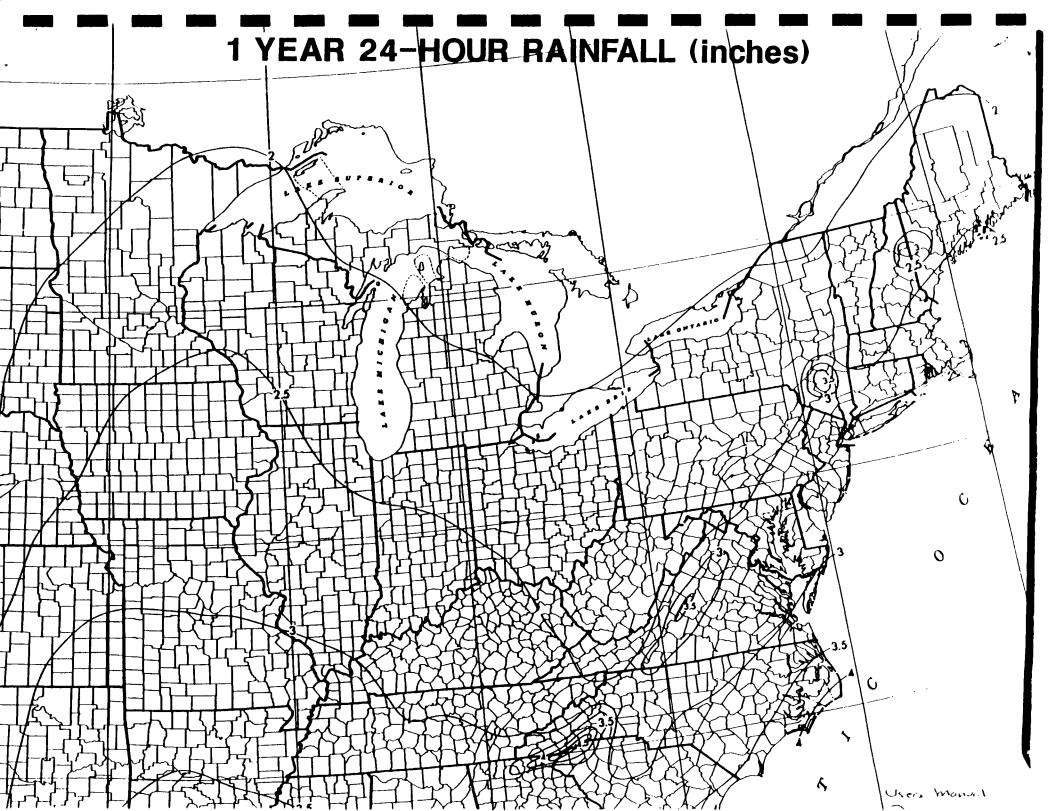
One-year 24-hour rainfall (obtained from Figure 8) indicates the potential for area storms to cause surface water contamination as a result of runoff, erosion, or flow over dikes. Assign a value as follows:

Amount of Rainfall	Assigned Value
(inches)	
<1.0	0
1.0-2.0	1
2.1-3.0	2
>3.0	3

Distance to the nearest surface water is the shortest distance from the hazardous substance, (not the facility or property boundary) to the nearest downhill body of surface water (e.g., lake or stream) that is on the course that runoff can be expected to follow and that at least occasionally contains water. Do not include man-made ditches which do not connect with other surface water bodies. In areas having less than 20 inches of normal annual precipitation (see Figure 5), consider intermittent streams. This factor indicates the potential for pollutants flowing overland and into surface water bodies. Assign a value as follows:

Distance	Assigned Value
>2 miles	0
1 to 2 miles	1
1000 feet to 1 mile	2
<1000 feet	3

Physical state is assigned a value using the procedures in Section 3.2.



### TABLE 9

Assign containment a value of 0 if: (1) all the waste at the site is surrounded by diversion structures that are in sound condition and adequate to contain all tunoff, spills, or leaks from the waste; or (2) intervening terrain precludes runoff from entering surface water. Otherwise, evaluate the containment for each of the different means of storage or disposal at the site and assign a value as follows:

CONTAINMENT VALUES FOR SURFACE WATER ROUTE

A. Surface Impoundment		C. <u>Heate Piles</u>	
<u>A.</u>	signed Value		Assigned Valu
Sound diking or diversion structure, adequate freeboard, and no erosion evident	0	Piles are covered and surrounded by sound diversion or containment system	0
Sound diking or diversion structure, but inadequate freeboard	1	Piles covered, wastes unconsolidated, diversion or containment system not adequate	1
Diking not leaking, out potentially unsound	2	Piles not covered, westes unconsoli- dated, and diversion or containment system potentially unsound	2
Diking unsound, leaking, or in danger of collapse		Piles not covered, wastes unconsolidated, and no diversion or containment or diversion	3
B. Containers		system leaking or in danger or collapse	
<u>A.</u>	signed Value	D. Landfill	
Containers sealed, in sound condition, and sur- rounded by sound diversion or containment system	0	·	Assigned Value
Containers sealed and in sound condition, but not surrounded by sound diversion or containment system	1	Landfill slope precludes runoff, landfill surrounded by sound diversion system, or landfill has adequate cover material	0
Containers leaking and diversion or containment atructures potentially unsound	2	Landfill not adequately covered and diversion system sound	1
Containers leaking, and no diversion or containment structures or diversion structures leaking or in		Landfill not covered and diversion system potentially unsound	2
danger of collapse	İ	Landfill not covered and no diversion system present, or diversion system unsound	3

REFERENCE NO. 13

06370

### NUS CORPORATION

TELECON NOTE

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REFERENCE NO. 14

### FINAL REPORT ADDITIONAL SITE ASSESSMENT FOR THE UNOCAL CHEMICALS/CARTERET SITE CARTERET, NEW JERSEY

### PREPARED FOR:

UNION OIL COMPANY OF CALIFORNIA
UNOCAL CHEMICALS DIVISION
SCHAUMBURG, ILLINOIS

DECEMBER 1986 PROJECT NO. 303331

PREPARED BY:

IT CORPORATION
PITTSBURGH, PENNSYLVANIA

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### FINAL REPORT

### ADDITIONAL SITE ASSESSMENT UNOCAL CHEMICALS/CARTERET SITE CARTERET, NEW JERSEY

### 1.0 INTRODUCTION

IT Corporation (IT) was retained in July 1985 by the Unocal Chemicals Division of the Union Oil Company of California (Unocal Chemicals) to conduct an initial site assessment at their facility in Carteret, New Jersey (Figure 1). The purpose of this initial site assessment was to define the in situ geologic and hydrogeologic conditions and to estimate the extent of possible ground water contamination at the site. The information collected during this assessment was then to be used to develop possible site remediation plans which would address the further seepage of organic contaminants into Noes Creek. A number of preliminary plans were developed; however, as this task proceeded, it became obvious that additional geologic and hydrogeologic data were needed at several key locations within the site before detailed design could be completed.

Following a discussion between Unocal Chemicals and IT relative to the findings of the Initial Site Assessment Report (ISAR) and Remediation Alternatives Report, it was decided that an additional site assessment program should be undertaken. A set of data collection objectives was established as a basis for the additional site assessment work. These objectives focused on the collection of the data which were needed to allow the design and construction phases of the project to proceed and included:

- o The collection of additional hydrogeologic, geologic, and chemical data to better characterize the deeper sand and gravel aquifer (deeper aquifer) which was found beneath the site during the initial site assessment
- o The collection of data to determine if site contaminants are migrating through the railroad ballast toward Roosevelt Avenue at the northeastern corner of the site
- o The collection of data to characterize the potential for vertical leakage through the barrier between the shallow and deeper aquifers

- o The collection and analysis of additional ground water samples to further characterize the relative qualities of the shallow and deeper aquifer waters and to determine if any correlations exist between the site's established analytical program parameters and possible indicator parameters such as total organic carbon (TOC) and total organic halogen (TOX)
- o The collection of water samples from Noes Creek to determine the potential impact of the site on the chemical composition of the stream.

The report which follows presents the results of the work which was completed during the additional site assessment program. The findings of this report are intended to supplement the preliminary findings and conclusions of the ISAR.

The remainder of the report consists of descriptions of the field operations which were conducted during the data collection effort (Chapter 2.0), a discussion of the results of the field investigation (Chapter 3.0), and the presentation of the conclusions and findings of the additional site assessment program (Chapter 4.0).

### 2.0 FIELD INVESTIGATION

The field investigation program was designed to better define the geology and hydrogeology within two portions of the site in particular. The first portion is located along the property line at the northern end of the site, and the second portion is located between existing Monitoring Wells 6 and 11 (Figure 2). The northern property line area was evaluated for two reasons; first, to expand the scope of the hydrogeologic portion of the overall field investigation to include the entire site area and, second, to collect information which might indicate whether contaminant migration is occurring near this property line. The Monitoring Well 6/11 area required further evaluation because it comprises a portion of the general area which will be impacted by proposed remedial action measures. The field operations for the additional site assessment program included the following tasks:

- o Soil drilling and sampling
- o Monitoring well installation and development
- o Ground and surface water sampling

- o Measurements of water levels
- o Hydraulic conductivity testing
- o Geodetic survey of monitoring wells and borings.

The work for this program was generally completed in the order presented above during the time period of June 2 through 7, 1986.

### 2.1 DRILLING AND SOIL SAMPLING

Six 6-inch-outside-diameter soil borings were drilled to selected depths into the shallower surface fills and natural soils using a truck-mounted drilling rig and hollow-stem augers. Two additional soil borings were drilled into the deeper natural soils (sands and gravels) using this same equipment. However, these deeper borings consisted of 12-inch-outside-diameter openings for the upper segments of the borings and 6-inch-outside-diameter openings for the lower segments. The need for these multiple borehole diameters is explained in Section 2.2. Figure 2 shows the locations of the eight new soil borings as well as the locations of the previously installed monitoring wells.

Soil samples were obtained both continuously and at selected intervals using a two-inch-outside-diameter split-barrel sampler or new Shelby tube decontaminated for each sample. The split-barrel sampler was driven ahead of the augers by a 140-pound hammer dropped 30 inches to provide Standard Penetration Test data (American Society for Testing and Materials [ASTM] Procedure D1586). Soil sample composites were collected from two-foot intervals starting at the ground surface. Each soil sample was placed in a new, clean 500-milliliter amber glass jar and sealed with a polyethylene-lined cap.

Two undisturbed soil samples were obtained for laboratory permeability testing from the barrier layer between the site's shallow and deeper aquifers. These samples were collected from Borings SB-1 and SB-2 using standard three-inch-diameter Shelby tubes pushed hydrostatically into the soils. Once satisfactory penetration was accomplished, a minimum of ten minutes was allowed to pass before sample recovery was attempted. This waiting period allowed for adequate reexpansion of the soils in the tube, ensuring better recovery. Upon recovery, each tube was properly labeled, sealed, and maintained in its upright normal orientation pending shipment.

Logs describing both the visual classification of the soils and the drilling conditions were prepared by the IT geologist supervising the operations (Appendix A). Four generalized geologic sections were prepared from these boring logs to characterize the underlying site stratigraphy (Figure 3). The locations of these sections are indicated in Figure 2.

Measurements of the concentrations of volatile organic vapors were obtained from the headspace regions of the soil sample jars by means of an H-nu photo-ionization meter. These measurements, which are listed in Table 1, provide an indication of the relative presence of volatile organic constituents in the site soils.

At the completion of the field program, all soil samples were transported, with completed chain-of-custody forms, to the IT laboratory in Export, Pennsylvania (IT laboratory) for temporary archiving. The samples arrived at the laboratory on June 10, 1986.

### 2.2 MONITORING WELL INSTALLATION AND DEVELOPMENT

Monitoring wells were installed in six of the eight soil borings to allow for the collection of ground water samples for chemical analysis and to provide a means for obtaining water level information for assessing the direction and rate of ground water flow. The installed wells consisted of the following components:

- o Two-inch-inside-diameter stainless steel pipe with flush threads
- o Wire-wound stainless steel well screen with 0.010-inch slots
- o Sand filter pack
- o Bentonite seal
- o Grout seal
- o Locking cap
- o Protective cover.

Upon completion of an appropriate soil boring, a stainless steel well screen and pipe were assembled and installed in the boring as instructed by the onsite IT geologist. Following placement of the well screen and pipe, a filter pack of silica sand (sand pack) was placed in the annulus between the well screen and the boring perimeter. The sand pack was generally installed such that the top of the pack was approximately one foot above the top of the well screen. A bentonite seal was installed on top of the sand pack to seal off the screened zone. Periodic depth measurements were made during the installation of both the sand pack and bentonite seal to ensure proper placement. A grout seal was then installed up to the ground surface in the remaining annular space of the well to impede the infiltration of surface water into the well. A locking cap was installed on the top of the riser pipe and a lamphole cover was set (in mortar) above the riser pipe but flush with the ground surface.

Two monitoring wells, MW-14 and MW-16, were installed into the deeper aquifer. The construction techniques for these installations were similar to those for the installations of the other wells but with additional placements of groutfilled, 10-inch-diameter polyvinyl chloride (PVC) casings within the upper portions of these borings. Construction of the wells involved augering 12-inch-diameter holes through the fill and six inches into the generally silty-clay and peat barrier layer which separates the shallow and deeper aquifers. Casings comprised of 10-inch-diameter PVC pipe were then installed in these holes and were seated into the generally silty-clay and peat layer. The cased openings were then filled with a bentonite grout mixture. The mixture was allowed to cure for about 12 hours before operations continued. The six-inch-diameter auger was then advanced through the grout mixture and into the underlying natural soils, and the well installations proceeded normally as described above.

The reason for the casing and grouting of the larger-diameter holes prior to drilling the well boring through the barrier layer and into the deeper aquifer was to minimize the possibility of cross-aquifer contamination. Such a precaution was not taken during the initial site assessment installations of Monitoring Wells 2 and 7 due to the unknown existence of the separate deeper aquifer at the time. Therefore, the analytical results for the previously obtained water samples from these wells are suspect.

The new well completion diagrams are presented in Appendix B. Monitoring well and soil boring elevations for the entire site are presented in Table 2. Comparison of the "top of well screen" elevations with the ground water elevations measured in corresponding wells (Table 3) indicates that at times a number of the shallow aquifer well screens (i.e., Monitoring Wells 6, 9, 10, 11, 12, and 13) have been totally submerged by the ground water. The implication of these occurrences will be discussed in Section 3.4.

The new wells, except for Monitoring Well 15 which was dry, were developed by pumping to remove fines from the well sensing zone to enhance communication between the water-bearing zone and the well. While pumping proceeded, the effluent was visually monitored for suspended solids content. When it was determined that the suspended solids content had diminished sufficiently, and at least three well volumes had been pumped from the well, development was assumed to be completed. All downhole equipment used to develop the wells was decontaminated between wells using hexane and methanol washes followed by distilled water rinses.

### 2.3 GROUND AND SURFACE WATER SAMPLING

Ground water samples were collected for chemical analysis on June 6 and 7, 1986 from 17 of the 18 on-site monitoring wells. Monitoring Well 15 was dry at the time the samples were collected. Prior to sampling, each well was purged of a minimum of three well volumes of water by bailing. Bailing and sampling were accomplished using a decontaminated point-source teflon bailer. Decontamination consisted of thoroughly washing the bailer using hexane then methanol followed by repeated rinsing with distilled water. The samples were generally obtained from the upper to middle portions of the water columns in the respective wells. Apparent "free product" was again visually observed in Monitoring Wells 5, 6, and 8, and a sample of the most obvious free product layer in Monitoring Well 6 was collected for analysis.

Two surface water samples were also collected on June 6, 1986 from Noes Creek for chemical analysis. Both samples were collected simultaneously during ebb tide by immersing the appropriate sample bottles in the creek water at the locations indicated in Figure 2. The water was approximately one-foot deep at

the points of sampling. The locations of the samples, S-1 and S-2, were chosen to represent conditions just upstream and just downstream, respectively, of the site.

Standard field parameters, i.e., sample temperature, pH, and specific conductance, were measured and recorded in the field for all water samples (Appendix C). Each sample was placed in a new, clean container, was appropriately preserved, and was then cooled to and maintained at wet ice temperature (four degrees Celsius) during transport to the IT laboratory. All samples were transported by means of ground transportation and were accompanied by completed chain-of-custody forms. The samples arrived at the laboratory on June 10, 1986 and were subsequently analyzed for the required constituents.

### 2.4 GROUND WATER LEVEL MEASUREMENTS

Measurements of the ground water levels in all monitoring wells were taken during both high and low tides on June 6 and 7, 1986, respectively. These measurements were manually obtained using a weighted sounding device attached to a measuring tape. The measurements were recorded on log sheets to the nearest 0.01 foot. The results of this water level measurement program are indicated in Table 3 along with results of previous measurement programs. Generalized ground water contour maps for the shallow aquifer were developed from these measurements and are presented in Figures 4 (high tide) and 5 (low tide).

### 2.5 HYDRAULIC CONDUCTIVITY TESTING

In situ permeability tests were conducted in Monitoring Wells 1 and 8 (Figure 2) following the above-described collection of ground water samples and measurement of water levels. The tests were performed to evaluate present well sensitivity (degree of communication between the well and water-bearing zone) and to estimate, or in the case of Monitoring Well 1 reestimate, the hydraulic conductivities of the water-bearing zones at the chosen locations. The tests were conducted by filling the well pipes with water to levels above the existing ground water levels in these wells and measuring the subsequent falls of these induced water levels as a function of time (falling head test).

The induced water level in Monitoring Well 8 dropped so rapidly to its original elevation that an acceptable measurement of this fall over time could not be obtained using available techniques. This occurrence cannot categorically be explained at this time except for the possibility that Monitoring Well 8 may intersect a thin, isolated lens of high-permeability fill material which is located above the normal water level in the well. Thus, no hydraulic conductivity value could be calculated for this well.

The hydraulic conductivity value of Monitoring Well 1 resulting from the falling head test was computed to be  $4.7 \times 10^{-4}$  centimeter per second (cm/s). This result is consistent with the previous rising head test result of  $2.1 \times 10^{-4}$  cm/s which was obtained for Monitoring Well 1 during the initial site assessment program. This outcome tends to also reinforce the credibility of the other hydraulic conductivity results which were obtained during the initial site assessment and ranged from  $1.3 \times 10^{-5}$  to  $3.5 \times 10^{-3}$  cm/s.

### 2.6 GEODETIC SURVEY OF MONITORING WELLS AND BORINGS

A geodetic survey was conducted at the site by Ensurplan (formerly Goodman Allgair and Scott), a local, registered surveying company, to provide both vertical and horizontal control for all monitoring wells and soil borings. Elevations were determined to the nearest 0.01 foot for the near-ground surface, the top of protective cover, and the top of riser pipe for all monitoring wells; and for only the near-ground surface for Borings SB-1 and SB-2. Wells and borings were horizontally located by measuring radial distances to permanent site structures. Well locations and pertinent elevations are provided in Figure 2 and Table 2, respectively.

### 3.0 RESULTS OF INVESTIGATION

The previous chapter provided a description of the field operations conducted during this additional site assessment. The following sections present discussions of both the criteria on which the project objectives (Chapter 1.0) and the plan of work were based, and the results of this work.

### 3.1 ADDITIONAL CHARACTERIZATION OF DEEPER AQUIFER

A sand and gravel aquifer (deeper aquifer) was found to exist at depths which varied from approximately 12 to 27 feet beneath the surface of the site during the initial site assessment program. The following work was planned as part of the additional site assessment program to better define the lateral extent of this deeper aquifer and its relationship to the shallow aquifer:

- o Soil boring and soil sample collection
- o Monitoring well installation
- o Ground water sample collection and analysis
- o Ground water level measurement.

As described in Section 2.2, two additional deep borings, MW-14 and MW-16, were drilled on site to supplement the information obtained from the drilling of Monitoring Wells 2 and 7 during the initial site assessment program (refer to Figure 2 for locations of wells). The locations of the new borings were chosen such that if the sand and gravel formation was again encountered in both of these borings, it could then be assumed that this soil layer extended beneath the entire site. Both borings did encounter this layer (Appendix A); therefore, it has been assumed, for the purposes of this report (i.e., cross sections, etc.), that the sand and gravel formation does extend beneath the

Monitoring wells were installed in each of the two borings for the purpose of collecting ground water samples and determining ground water levels. The information obtained from both the ground water analyses and the water level measurements was intended to be used to better define the hydrogeologic relationship between the overlying shallow aquifer and this deeper aquifer.

The results of the ground water analyses are discussed in detail in Section 3.4. However, these results generally imply that the potential for migration of contaminants from the shallow aquifer, through the existing barrier layer, and into the deeper aquifer may not be as great or extensive as the initial site assessment analytical results may have suggested. The deeper aquifer Monitoring Well 16 was found to be relatively "clean," while the closest of the nearby shallow aquifer wells for which the complete list of volatile constituents was measured, Monitoring Well 17 (Figure 2), appeared to be potentially contaminated (Table 4). The deeper aquifer Monitoring Well 14

was also found to be relatively "clean" although this well is likely upgradient from the on-site contaminant sources. Thus, a definitive statement about the relationship between the shallow and deeper aquifers, relative to the integrity of the barrier layer in minimizing contaminant migration, cannot be made at this time in light of the existing water quality data. Additional data are needed for evaluation prior to the formulation of any conclusions on this matter.

The evaluation of the ground water elevation data contained in Table 3 regarding the quantification of the vertical gradient which should exist between the shallow and deeper aquifers indicates that this gradient likely varies with time in both magnitude and direction. This outcome is predictable in a tidally influenced environment such as exists on site. Thus, the existing ground water elevation data are not sufficient for developing meaningful conclusions or observations relative to the impact of natural piezometric head differential on the potential for contaminant migration through the barrier layer between the aquifers. Continuous ground water level measurements must be acquired before a realistic piezometric relationship between the shallow and deeper aquifers can be established. It can, however, be stated that an "upward" vertical gradient appears to have, at least intermittently, existed and may still intermittently exist. These occurrences will tend to minimize the potential for downward migration of contaminants from the shallow aquifer.

### 3.2 CONTAMINANT MIGRATION THROUGH THE RAILROAD BALLAST

The area in question is located in the northeastern section of the site near Roosevelt Avenue where the railroad track runs between the plant office and warehouse. The additional work planned for this area included the installation of a ground water monitoring well, MW-15 (Figure 2), from which soil and water samples could be collected. It was reasoned that the selected well location should be in the pathway of any ground water which had the potential to flow away from the site through the typically highly permeable track ballast. Ground water samples were to be collected from this well for analysis to determine if contaminants might also be migrating with such ground water. The well was installed in the upper fill with the bottom of the screened interval located in the top of the generally silty-clay and peat barrier layer beneath the fill. However, an insufficient amount of ground water flowed into

the well during the course of the field work, and the plan to collect and analyze ground water samples from this well had to be abandoned.

The fact that the well was essentially dry following installation does allow an observation to be made concerning this area. That is, it does not appear that the shallow aquifer extends into this local area under normal weather and low tide conditions. Supporting this observation are the soil boring logs (Appendix A) and geologic cross sections (Figure 3) which indicate that the top of the generally silty-clay and peat barrier layer, above which the shallow aquifer is perched, slopes away from this area toward the southern and central portions of the site. Thus, the probable intermittent occurrence of ground water in this area minimizes the potential for localized off-site contaminant migration through the railroad ballast.

### 3.3 LEAKAGE POTENTIAL OF BARRIER LAYER

Concern over the possibility of leakage of the shallow aquifer contaminants into the deeper aquifer dictated the need for evaluating the leakage potential of the generally silty-clay and peat barrier layer which exists between the aquifers. The evaluation was to be based on the results of the ground water level measurement program and the results of laboratory permeability testing of the two samples which were collected from the barrier layer during the field operations (Section 2.1). Additionally, insight was hoped to be gained from the results of the ground water sample analyses.

As discussed in the previous section and as will be discussed in Section 3.4, existing ground water quality data are inconclusive with respect to supporting or denying the occurrence of past substantial leakage and associated contaminant migration from the shallow aquifer into the deeper aquifer. Thus, a qualitative means of characterizing the leakage potential of the barrier layer is not presently available. As has also been discussed, the existing ground water elevation data are too sparse and discontinuous to be used to quantify the relative magnitude and dominant direction of leakage. Thus, one of the primary means of characterizing the leakage potential is not presently available. However, the results of the laboratory permeability testing indicate that the barrier layer, at least in the general areas sampled, is not very permeable. This outcome will tend to minimize the potential for downward

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leakage in these areas and in other areas where the barrier layer has similar properties.

The laboratory permeability tests were conducted in the IT laboratory. The two undisturbed samples on which the tests were conducted were collected from the generally silty-clay and peat layer which was encountered in Borings SB-1 and SB-2 (Figure 2), as previously described. The results of the permeability tests are provided in Appendix C. These results indicate that the portion of the barrier layer represented by the SB-1 sample has a permeability on the order of 3.1 x 10<sup>-8</sup> cm/s, and the portion of the barrier layer represented by the SB-2 sample has a permeability on the order of 2.4 x 10<sup>-8</sup> cm/s. These results compare favorably with the permeabilities typical of soil-bentonite design mixes used in the construction of slurry walls which are themselves often used to contain contaminated subsoils and/or ground water. Thus, the represented barrier layer materials can be described as low-permeability mate-

# 3.4 GROUND WATER QUALITY EVALUATION

The results of the analyses of the ground water samples which were collected from the new monitoring wells are presented in Tables 4 and 5. Monitoring Well 15 is not represented in these tables since samples could not be obtained as explained previously. The results of the analyses of the ground water samples which were collected from the remaining monitoring wells during the additional site assessment are presented in Table 5.

# Shallow Aquifer

The Table 4 results regarding the shallow aquifer indicate that the Monitoring Well 13 area appears to be relatively "clean," whereas the Monitoring Well 17 and 18 areas may be somewhat contaminated. All measured volatile organic constituents, if they existed at all, were found to be below the analytical method detection limits for Monitoring Well 13. The Monitoring Well 17 analyses found a number of elevated volatile organic concentration levels, with total xylenes and toluene having the highest levels among the more hazardous constituents (i.e., benzene, chlorobenzene, ethylbenzene, tetrachloroethylene, toluene, [1,1,1]-trichloroethane, vinyl chloride, and xylene, as per the

"Qualitative Risk Assessment" section of the ISAR). The Monitoring Well 18 analyses also found a number of elevated volatile organic concentration levels, with chlorobenzene, benzene, and total xylenes having the highest levels among the more hazardous constituents.

These shallow aquifer analytical results coupled with the initial site assessment analytical results for the shallow aquifer (reproduced as Table 6 herein) have allowed the development of a graphical depiction of the suspected General Contaminant Source Area (GCSA) within the shallow aquifer (Figure 6). The limits of the GCSA boundary were approximated from consideration of the general facility layout and operation, the site stratigraphy, and the analytical data. The major storage tank operations are associated with the interior of the site, and a review of the site stratigraphy indicates that the top of the barrier layer tends to slope away from the northern, eastern, and western boundaries and toward the central and southern portions of the site. Review of the analytical data of Tables 4 and 6 for the shallow aquifer wells indicates that the measured concentrations of the more hazardous constituents (defined above) for the wells within the GCSA limits are on the order of a magnitude or more greater than the corresponding measured concentrations of these constituents for the wells outside of the GCSA. Thus, the GCSA provides a visual interpretation of the existing shallow aquifer analytical data relative to the greatest concentrations of contaminants and represents the most likely area in need of remediation.

### Deeper Aquifer

The Table 4 results regarding the deeper aquifer wells indicate that both Monitoring Wells 14 and 16 appear to be relatively "clean." All measured volatile organic constituents, if they existed at all, were found to be below the analytical method detection limits for Monitoring Well 16. The same was true for Monitoring Well 14, except for the measured presence of chloroform and tetrachloroethylene which were found in concentrations slightly above their detection limits and for the measured presence of trichloroethylene which was found at a level within an order of magnitude of its detection limit. Only tetrachloroethylene belongs to the "more hazardous constituent" group which was previously defined.

In comparing the deeper aquifer analytical results for Monitoring Wells 14 and 16 (Table 4) with those previously obtained during the initial site assessment for Monitoring Wells 2 and 7 (Table 6), it must be noted that Monitoring Wells 2 and 7 were installed without the precautionary measures employed during the installation of Monitoring Wells 14 and 16 (Section 2.2). Thus, it is possible that the analytical results reported for Monitoring Wells 2 and 7 may reflect conditions affected by the drilling operations even though the standard installation, development, and purging procedures were closely adhered to at the time that these wells were installed and sampled. The existence of a significant site-related contaminant plume in the deeper aquifer cannot, therefore, be verified at this time, especially in light of the analytical results for Monitoring Wells 14 and 16. However, the existing data do indicate that, if a plume actually exists, it is not very extensive relative to the northern, western, and eastern site boundaries.

# Indicator Parameters

The results of the most recent analyses for TOC and TOX are presented in Table 5. The results of the previous analyses for these parameters during the initial site assessment are presented in Table 6. Review of both sets of results indicates that neither of the parameters can be depended upon to be a reliable, consistent indicator of the occurrence and/or relative magnitude of elevated levels of the more hazardous constituents (as defined previously) associated with the site. For example, Table 6 indicates that Samples MW-1T,

MW-7T, MW-10T, and MW-10B all have TOC values in the range of 12 to 14 parts per million (ppm); however, Monitoring Well 1 is considered to be relatively "clean" while Monitoring Wells 7 and 10 had significantly elevated levels of chlorobenzene and/or total xylenes. Additionally, the highest TOC concentration in Table 6 corresponds to one of the "cleaner" wells, Monitoring Well 3, while Tables 4 and 5 illustrate that the apparently most contaminated well of those represented in these tables, Monitoring Well 6, did not have the highest TOC concentration. In regard to a similar inconsistency in the TOX measurements, Tables 4 and 5 show that Samples MW-14 and MW-18 had the same TOX concentrations of 1.0 ppm, while Samples MW-16 and MW-17 had the same TOX concentrations of 0.15 ppm; yet Monitoring Wells 14 and 16 appear to be relatively "clean" and Monitoring Wells 17 and 18 may be contaminated. Therefore, it cannot be recommended that the TOC and TOX parameters be used to substitute for the actual measurements of the more hazardous constituent concentrations.

# Future Sampling Protocol

It has become apparent that several of the shallow aquifer well screens have been totally submerged at times in the past by the ground water (Section 2.2). These occurrences are not necessarily detrimental to the use of any of the monitoring wells or to the existing analytical results of samples obtained from the wells. However, there is the possibility that a sample collected from or near the top of the water column in a well which has had its well screen submerged for any length of time may not actually be representative of the top of the water table outside of the well at the time of sampling. This may especially be true in an environment where free product may be present atop the ground water table. Thus, to ensure that representative samples are being obtained during any future ground water sampling program, water level measurements should be taken prior to sampling and "top" samples should be collected only if and when the water level in a particular well is below its top-of-well-screen elevation. The relative elevations of the ground water table and the top of a well screen should not impact the collection of a "bottom" sample from a given well.

# 3.5 SURFACE WATER QUALITY EVALUATION

Two water samples were collected from Noes Creek, one west (SW-1) and one east (SW-2) of the site (Figure 2). The locations were chosen such that during ebb

tide it was expected that the quality of the water flowing to location (SW-1) would not be influenced by the site and, conversely, the quality of the water flowing to location (SW-2) would be influenced by the site. The results of the analyses indicate that for all parameters measured in excess of their detection limits, except sulfate, concentrations were higher upstream (SW-1) than downstream (SW-2). This occurrence may be attributable to a presently unknown off-site, upstream source of contamination or possibly to the entrainment of site-related constituents as the tide moves up Noes Creek past the site. In any event, the limited surface water sampling program does tend to demonstrate that the concentrations of the more hazardous volatile organic constituents measured in Noes Creek are significantly lower than the concentrations of these constituents measured in the on-site shallow aquifer. Apparently, volatile organic contaminant attenuation is occurring which will tend to minimize the possible site-related impairment of Noes Creek. This outcome is most likely due largely to the turbulence and associated mixing which probably occurs as the tide moves past the site. However, a definitive conclusion regarding the degree to which Noes Creek is contaminated with siterelated constituents cannot be formalized at this time, except to state that the limited data tend to support the possibility of minimal volatile organic contamination.

4.0 CONCLUSIONS AND FINDINGS

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The conclusions and findings of this additional site assessment program are summarized below with respect to the data collection objectives which were outlined in Chapter 1.0:

- o Characterization of the deeper sand and gravel aquifer
  - The sand and gravel formation appears to be present beneath the entire lateral extent of the site.
  - The top of the sand and gravel formation was found at depths of 12 to 27 feet below the surface of the site.
  - A generally silty-clay and peat barrier layer appears to be present between the shallow and deeper aquifers. The integrity of this barrier layer relative to the prevention or minimization of downward contaminant migration cannot be fully established at this

time. Additional data are needed to be gathered and reviewed to further assess the barrier layer as discussed in Section 3.1.

- Determination of the potential for migration of contaminants through the railroad ballast
  - The probable intermittent occurrence of ground water in the subject area minimizes the potential for contaminant migration through the railroad ballast. However, the continuous tidal influence on Monitoring Well 15 should be assessed to further justify the above observation.
- o Characterization of the potential for vertical leakage through the barrier layer
  - Laboratory permeability testing on soil samples obtained from the barrier layer yielded results which indicated that the barrier materials may be low-permeability materials which minimize the potential for downward leakage. However, additional data may need to be acquired to verify the areal extent of the low-permeability zone.

- Adequate piezometric and/or water quality data are not presently available to quantify or further qualify the vertical leakage potential. However, the acquisition of the additional data discussed in Section 3.1 should address this matter.

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- o Evaluation of ground water quality
  - The GCSA (Figure 6) was developed as a visual interpretation of the existing shallow aquifer analytical data relative to the greatest concentrations of contaminants and to represent the most likely area in which the remediation efforts should be focused.
  - The existence of a site-related contaminant plume in the deeper aquifer cannot be verified at present.

    Additional ground water quality data are needed for evaluation before a definitive conclusion can be drawn concerning this matter.
  - TOC and/or TOX are not reliable, consistent indicators of the presence of the more hazardous constituents associated with the site.
  - In the future, water level measurements should be taken prior to the collection of a ground water sample from the top of the water column in a well to determine whether the particular well screen is submerged.

- o Evaluation of surface water quality
  - The limited data tend to support the possibility of minimal volatile organic contamination of Noes Creek. However, additional data should be acquired before a definitive conclusion is drawn concerning the magnitude of the site-related contamination of Noes Creek.

Sufficient data appear to now exist with which to carry forward the design of a shallow aquifer ground water control scheme to contain, collect, and treat the ground water within the GCSA. The design of the potential ground water collection well system(s) will be dependent on sensitivity analyses conducted on representative values of hydraulic conductivity and horizontal hydraulic gradient for the site. The system(s) will then be adjusted, via pumping rates and well spacings, to account for the "worst" practical conditions. The consideration of the continuous ground water level information discussed in Section 3.1 will, however, allow for the selection of the most representative horizontal hydraulic gradient values.

TABLES

TABLE 2
MONITORING WELL AND SOIL BORING ELEVATIONS(a)

МО	NITORING WELL OR SOIL BORING	TOP OF COVER OR GROUND	TOP OF INSIDE PIPE(b)	TOP OF WELL SCREEN	BOTTOM OF WELL OR BORING
	MW-1	8.98	8.27	4.98	-1.02
1	MW-2	8.47	7.60	-3.53	-21.53
	MW-3	9.31	8.63	7.11	1.31
	MW-4	9.30	8.50	7.30	1.30
	MW-5	9.16	8.58	7.16	1.16
,	MW-6	8.84	8.23	4.54	-7.16
1	MW-7	8.83	7.89	-17.17	-23.17
<u>ا</u> نغ	MW-8	9.43	8.55	7.43	-4.57
( , ,	MW-9	10.40	9.57	7.40	-4.60
1	MW-10	10.83	10.01	8.83	2.83
	MW-11	11.25	10.43	9.25	3.25
	MW-12	12.48	11.79	10.48	4.48
•	MW-13	12.34	11.74	8.34	•
}	MW-14	13.37	12.53	-5.63	2.34
l	MW-15	9.56	9.14		-16.63
(	MW-16	9.80		8.06(c)	3.36
1	MW-17		9.32	-8.40	-19.40
		9.63	9.23	5.63	-5.37
}	MW-18	(d)	(d)	(4)	( <b>a</b> )
J	SB-1	9.1	-	-	-8.90
1	SB-2	9.6	-	-	-4.40

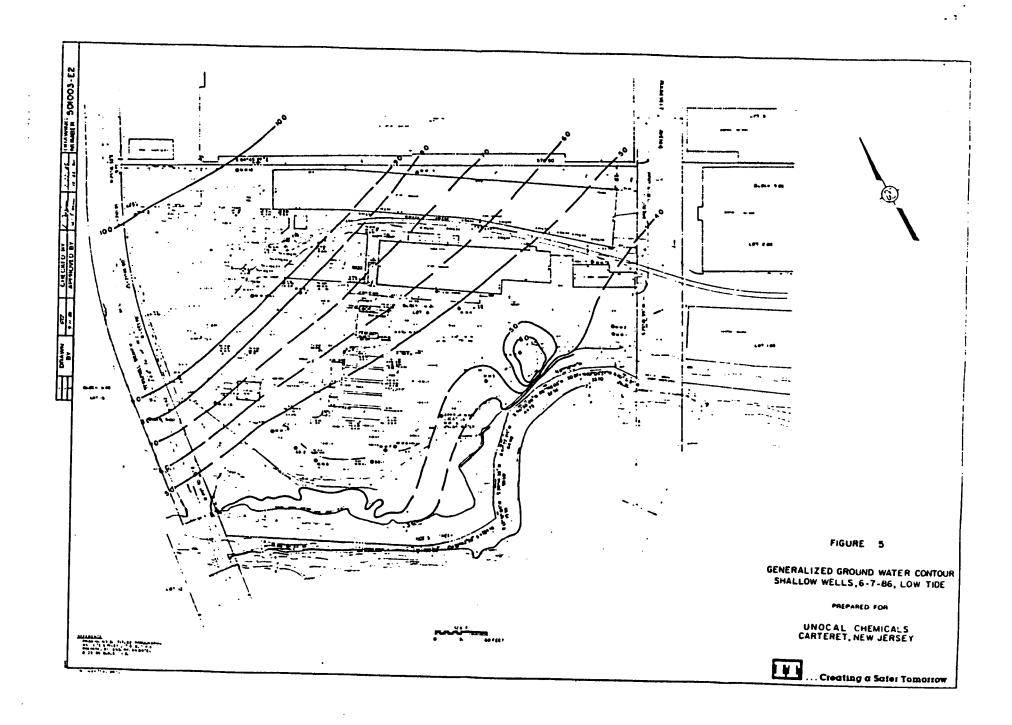
<sup>(</sup>a)Elevations in feet (mean sea level).

NOTE: Monitoring Wells MW-13 through MW-18 were installed during the additional site assessment investigation. Monitoring Wells MW-1 through MW-12 were installed during the initial site assessment investigation.

<sup>(</sup>b) Top of the bottom section of the locking cap.

<sup>\ (</sup>c)Elevation of the top of sand pack.

<sup>(</sup>d) Elevations were not measured as the well cover area was flooded at the time of the survey.



APPENDIX A
SOIL BORING LOGS

# GENERAL NOTES AND LEGEND

# Symbols to be used for designation of subsurface materials on all boring logs and subsurface sections

ASPHALT CRAFEL LIMESTONE BOLOMITE SILTSTONE CONGLOWERATE CONCRETE SILT SANCS TONE VOID INDICATES SIZE OF VOID MASSIVE MICSTONE WATER OPGANIC MATTER SHALE APPROXIMATE EXISTING ROOTS APPROXIMATE TOP

STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2 INCH O. D. SPLIT BARREL SAMPLER 12 INCHES USING A 149 POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER WAS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6 INCH INTERVAL. THE RESISTANCE TO PENETRATION IS INDICATED ON THE DRAWING AS BLOWS PER FOOT.

THE BORING LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING LOCATIONS ALSO THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE BORING LOCATIONS

2" OD SPLIT BARRE, SAMPLE

75/0 5" PENETRATION REFUSA, RESISTANCE AND FRACTIONAL INCREMENT DRIVEN IN FEET

GROUND WATER LEVE. AND DATE

U.S.C.S. UNIFIED SOIL CLASSIFICATION SYSTEM (CAPITAL LETTERS MOICATE LAB TEST CLASSIFICATION LOWER CASE LETTERS MOICATE VISUAL FIELD CLASSIFICATION)

ROD GROCK QUALITY DESIGNATION PERCENT!

GENGTH OF NUMBER DE PIECES GREATER THAN 4 INCHES
DIVIDED BY THE LENGTH OF THE CORE RUN)

RECOVERED DIVIDED ST LENGTH OF CORE RUNN

TRACE - INDICATES PRESENCE OF S. TO. 2% OF SUBJECT MATERIAL BY WEIGHT SOME - INDICATES PRESENCE OF 12 TO 30% OF SUBJECT MATERIAL BY WEIGHT AND - INDICATES APPROXIMATELY EDUAL POPTIONS OF SUBJECT MATERIAL BY OF GHT

MICRO LAMINATED

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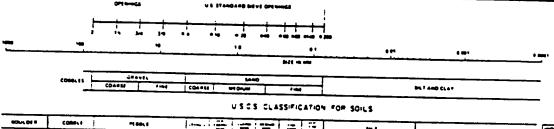
-

DE4SITY OF	GRANULAR SOILS
DESIGNATION	BLOWS PER FOOT
VERY WOSE	0.4
LOCSE	5 10
MEDIUM DENSE	11 30
DEMSE	31 50
VERY DENSE	Over 50

VERY THICK BEDDED OF MASSIVE	THICKER THAN 33R
THICK BEDDED	1-3 3 R
MEDIUM BEDOED	4 12 10
THIN BEDOED	1-4 m
VERY THIN BEDDED	2/5-1 in
LAMINATED	1/8-2/5 m
THINLY LAMINATED	102.10

THINNER THAN 1/32 in

TERMS USED TO DESCRIBE BEDDING THICKNESS



	1804	========	m' I	Char .	
Cond' Sedant Comercial assets a			BHL FEFORM	Sharfeet and want	COMMO
		WENTWORTH SCALE FOR	ROCK		#0K #

TERMS USED TO DESCRIBE THE RELATIVE DEGREES OF ROCK CORE HARDNESS

DESCRIPTIVE TERMS	DEFINING CHARACTERISTICS
VERY SOFT	CRUSHES UNDER PRESSURE OF PINGERS AND/OR THUMB
SOFT	CRUSHES UNDER PRESSURE OF PRESSED HAMMER
MEDIUM HARD	BREAKS EASILY UNDER SINGLE HAMMER BLOW BUT WITH CRUMBLY EDGES
HARD	BREAKS UNDER ONE ON TWO STRONG HAMMER BLOWS BUT WITH RESISTANT SHARP EDGES
VERT HARD	BREAKS UNDER SEVERAL STRONG MAMMER BLOWS BUT WITH VERY RESISTANT SHARP EDGES AND MAY SPALL LEAVING CONCHOIDAL FRACTURE

THE SPACING OF THE DISCONTINUITIES
IN THE ROCK MAY BE DESCRIBED
BY ONE OF THE FOLLOWING TERMS

SPAC:NG
LESS THAN I IN
TIN TO BIN
3 IN TO 6 IN
6 IN AND GREATER

•	DATE E	BEGAN:	<u>5-5-86</u>			В	ORING	NO	S8-1				EI.	- n	EXICU	VEED	. G.	H. & D	ш
	DATE F	""J-"	<del>5-5-86</del>								-							HOLZMA	
	GROUN	D SURFACE	EL:	9.1'	1	NN		E				_	G	TECK.	בט ם	11: -			
	ELEV. (FEET)	DEPTH (FEET)	SAME	PROFILE			DESCRI	PTION		-	١	<u> </u>	R	ESIS WS P	RATIO	Έ	)	REMAI	RKS
			s		FILL: SOME	(MEDIUM CLAY, B EL — MOI	RICK FR	BROWN AGMENT:	FINE SAN S AND FIN	ID . NE 2.0'	sp								
	6-5-8				U SANDY	(MEDIUM CLAY, S RAVEL —	SOME BR	ICK FRA	NE GMENTS A	סאג	d								
		5.0	5	$\langle \overset{\infty}{\otimes}$	FILL: (	SOFT, BR SOME FIN	OWN TO IE GRAVI	BLACK EL - MO	•	.0'	d	-			_	-		CK TAR	
		7.5	S		K SAND.	LOOSE, B SOME CL FRAGMEN	AY. FINE	CRAVE	OARSE	.0	sw						IN E	ERIAL I IOTTOM AND 1	OF
	0.0	10.0	5		NO REC						-							•	
		12.5	5		BLACK	ERY LOO FINE TO INE GRAV T)	COARSE	SAND.	N TO SOME FRAGMENT 12.	- 1	sw		ОН						
			7		LOOSE, MOIST	DARK BR	OWN TO	BLACK	PEAT,	0.	pt								
		15.0												+					
	-8.9	17.5 18.0	ST-1 ~29	•	LOOSE, (	DARK BR	OWN TO	BLACK	PEAT		pt								
						вотто	M OF B0	ORING											
											}	-	+			$\dashv$			

BORING NO. SB-1 SHEET 1 OF 1

DATE PRISHED: 6-5-88 GROUND SURFACE EL: 9.6'  N E  BORTING NO. S8-2  FILL OCCEPTION  RESISTANCE (FEET) TYPE E  SUBJECT AND AND SLAG FRAGMENTS - 2  FILL (LOSE, BROWN FINE SAND, SOME CLAY, SLIT AND BRICK FRAGMENTS - 2  FILL (MEDIUM STIFF, BROWN FINE SAND, SOME CLAY, SLIT AND BRICK FRAGMENTS - 2  FILL (MEDIUM STIFF, BROWN FINE SAND) AND STOP FRAGMENTS - 3  FILL (MEDIUM STIFF, BROWN FINE SAND) AND SHOOD FRAGMENTS - 3  FILL (MEDIUM STIFF, BROWN FINE SAND) AND WOOD FRAGMENTS, TRACE PEAT - MOIST)  FILL (VERY LOOSE, BLACK FINE TO FRAGMENTS - MOIST)  FILL (VERY LOOSE, BLACK FINE TO FRAGMENTS - MOIST)  FILL (VERY LOOSE, BLACK FINE TO FRAGMENTS - MOIST)  FILL (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT - MOIST)  PEAT - MOISTON  FRAGMENTS - MOIST)  PEAT - MOISTON  FRAGMENTS - MOIST)  PEAT - MOISTON  FRAGMENTS - MOIST)  PEAT - MOISTON  FRAGMENTS - MOIST)  PEAT - MOISTON  FRAGMENTS - MOIST)  PEAT - MOISTON  FRAGMENTS -	;	DATE BEGAN: 6-5-86	BORING NO. SB-2	SS a Suguesta C H to D II
GROUND SURFACE EL: 9.6' N E  ELEV. DEPTH (FEET) SAMPLE		DATE FINISHED: 6-5-86	DOIGHT NO	B 1101 =
ELEY, DEPTH SAMPLE B DESCRIPTION G RESISTANCE OF REMARKS  FILL: (VERY LOSE, BROWN FINE SAND, SOME CLAY, SLIT AND BRICK FRAGMENTS — BP  FILL: (MEDIUM STIFF, BROWN FINE SAND)  SOME SAND CLAY, SOME TAR LINE MOIST  AND WOOD FRAGMENTS, TRACE  FEAT — MOIST)  FILL: (VERY LOSE, BLACK FINE TO REMARKS AND WOOD FRAGMENTS — MOIST)  SOME SAND, SOME SLIT, FINE GRAVEL  AND WOOD FRAGMENTS, MOIST)  FILL: (VERY LOSE, BLACK FINE TO REMARKS AND WOOD FRAGMENTS — MOIST)  FILL: (VERY LOSE, BLACK FINE TO SOME SLIT AND WOOD FRAGMENTS — MOIST)  FILL: (VERY LOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, PMST)  FILL: (VERY LOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, PMST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING	.		N F	CHECKED BY: D. HOLZMAN
FILL: (VERY LOOSE, BROWN FINE SAND, SOME CLAY, SILT AND BRICK FRAGMENTS — sp MISTS — sp		SHOOKS SORFACE EL:		<del></del>
FILL: (VERY LOOSE, BROWN FINE SAND, SOME CLAY, SILT AND BRICK FRAGMENTS — sp MISTS — sp	1	ш		
FILL: (VERY LOOSE, BROWN FINE SAND, SOME CLAY, SILT AND BRICK FRAGMENTS — sp MISTS — sp	ı	ELEV. DEPTH SAMPLE 2	OSCORIO TO L	
FILL: (VERY LOOSE, BROWN FINE SAND, SOME CLAY, SILT AND BRICK FRAGMENTS — sp MISTS — sp		(FEET)   (FEET)   TYPE   2	DESCRIPTION	IN CRICUS PER FOOT
S FILL: (VERY LOOSE, BROWN FINE SAND, SOME CLY AND AND SLAG FRAGMENTS — sp    SOME CLY AND AND SLAG FRAGMENTS — sp   SOME CLY AND AND SLAG FRAGMENTS — sp   CLAY, SILT AND BRICK FRAGMENTS — sp   SOME CLAY, SILT AND BRICK FRAGMENTS — sp   SOME CLAY, SILT AND BRICK FRAGMENTS — MOIST     S FILL: (MEDIUM STIFF, BROWN TO BLACK MATERIAL AND METAL FRAGMENTS, TRACE     CLAY, SOME WOOD FRAGMENTS, TRACE     CLAY, SOME WOOD FRAGMENTS, TRACE     CLAY, SOME WOOD FRAGMENTS, BD     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE, BLACK FINE TO CHARLE AND WOOD FRAGMENTS — MOIST)     S FILL: (VERY LOOSE,	}	<u>ā</u>		1 -: 1(200,2 ; 1/2 ; 001))
SOME CLAY AND AND SLAG FRAGMENTS — SP    SOME CLAY AND AND SLAG FRAGMENTS — SP   FILL: (LOSSE, BROWN FINE SAND, SOME CLAY, SILT AND BRICK FRAGMENTS — MOIST   4.0'   SOME CLAY SILT AND BRICK FRAGMENTS — MOIST   4.0'   SOME CLAY SOME TAR LINE   4.0'   SOME SANDY CLAY, SOME TAR LINE   4.0'   SOME SANDY CLAY, SOME TAR LINE   4.0'   SOME TRAGMENTS — MOIST   4.0'   SOME TRAGMENTS — MOI		\s / <b>\</b>	FILL: (YERY LOOSE, BROWN FINE SAND.	
FILL: (LOSE, BROWN FINE SAND, SOME CLAY, SILT AND BRICK FRAGMENTS — 4.0'  5.0 S FILL: (MEDIUM STIFF, BROWN TO BLACK MATERIAL AND METAL FRAGMENTS — MOIST)  7.5 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE of FRAT — MOIST)  8.0'  7.5 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE of FRAT — MOIST)  8.0'  10.0 S FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE of FRAT — MOIST)  9.0 ID.0 S FILL: (MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  12.5 S FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  9.0 FILL: (MEDIUM STIFF, BROWN FI		$\vdash \dashv \times \bowtie$	SOME CLAY AND AND SLAG FRAGMENTS -	[ •n
FILL: (LOSSE BROWN FINE SAND, SOME  MOIST)  S.O  FILL: (MEDIUM STIFF, BROWN TO BLACK MATERIAL AND METAL FRAGMENTS - MOIST  S  FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE PEAT - MOIST)  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS - MOIST)  S  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS - MOIST)  S  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS - MOIST)  S  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT - MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING		<b>⊢</b>	MOIST	*
FILL: (LOSSE BROWN FINE SAND, SOME  MOIST)  S.O  FILL: (MEDIUM STIFF, BROWN TO BLACK MATERIAL AND METAL FRAGMENTS - MOIST  S  FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE PEAT - MOIST)  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS - MOIST)  S  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS - MOIST)  S  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS - MOIST)  S  FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT - MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING	۱ ۱	6-5-86		
S FILL: (WEDIUM STIFF, BROWN TO BLACK FINE SANDY CLAY, SOME TAR LIKE MATERIAL AND METAL FRAGMENTS — MOIST d FILL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE PEAT — MOIST)  S CLAY, SOME WOOD FRAGMENTS, TRACE PEAT — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  PEAT ENCOUNTERED AT 14.0'  BOTTOM OF BORING  14.0'	. 1	2.5 s	FILL: (LOOSE, BROWN FINE SAND, SOME	
FILL: (MEDIUM STIFF, BROWN TO BLACK FINE SANDY CLAY, SOME TAR LIKE MATERIAL AND METAL FRAGMENTS — MOIST  S CLAY, SOME WOOD FRAGMENTS, TRACE PEAT — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  PEAT ENCOUNTERED AT 14.0'  BOTTOM OF BORING  14.0'	-		ICLAY SIT AND RRICK EPACHENTS	
FILL: (MEDIUM STIFF, BROWN FINE SANDY CLY, SOME WOOD FRAGMENTS, TRACE  7.5  S FILL: (MEDIUM STIFF, BROWN FINE SANDY CLY, SOME WOOD FRAGMENTS, TRACE  PAT - MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, RINE GRAVEL AND WOOD FRAGMENTS - MOIST)  10.0  S FILL: (VERY LOOSE, BLACK FINE TO FRAGMENTS, FINE GRAVEL AND WOOD FRAGMENTS - MOIST)  PAT - MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT - MOIST)  PEAT ENCOUNTERED AT 14.0'.  BOTTOM OF BORING		F -1/2\XX		*P  \
S.0  SPILE SANDY CLAY, SOME TAR LIKE MATERIAL AND METAL FRAGMENTS — MOIST  SCHIL: (MEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE PEAT — MOIST)  SPILE: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  10.0  SPILE: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  FILE: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME WOOD FRAGMENTS, FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  PEAT ENCOUNTERED AT 14.0'  BOTTOM OF BORING  14.0'	- 1	<u> </u>		
MATERIAL AND METAL FRAGMENTS — MOIST d  S   FILL: (MEDIUM STIFF, BROWN FINE SANDY CLY, SOME WOOD FRAGMENTS, TRACE PART — MOIST)  S   FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S   FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  S   FILL: (VERY LOOSE, BLACK FINE TO GOARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  12.5   S   FILL: (VERY LOOSE, BLACK FINE TO GOARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  PEAT DECOUNTERED AT 14.0'.  BOTTOM OF BORING  14.0'	-	F 50 ∃\\$\\X	FILE (MEDIUM STIFF, BROWN TO BLACK	
S FILL: (WEDIUM STIFF, BROWN FINE SANDY CLAY, SOME WOOD FRAGMENTS, TRACE PLAT — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  PEAT — COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL PEAT — MOIST)  PEAT — PROCUNTERED AT 14.0'.  BOTTOM OF BORING	İ		MATERIAL AND METAL FRAGMENTS - MOIST	a <del>                                    </del>
CLAY, SOME WOOD FRAGMENTS, TRACE PEAT — MOIST)  10.0  S  FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S  FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  12.5  S  FILL: (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING		F	= molor	_     \
CLAY, SOME WOOD FRAGMENTS, TRACE PEAT — MOIST)  10.0  S  FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S  FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  12.5  S  FILL: (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING		F <del>- K - XXX</del>	FILL (VEDILIN STEE BROWN SHE CANDY	
7.5 4 PEAT — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  FILL: (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING	- 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CLAY, SOME WOOD FRAGMENTS, TRACE	
FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  S FILL: (YERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  FRAGMENTS — MOIST)  S FILL: (YERY LOOSE, BLACK FINE TO COLARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'	- 1		PEAT - MOIST)	d     /
S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND WOOD FRAGMENTS — MOIST)  10.0  10.0  5  FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  12.5  5  FILL: (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  80  80  80  80  80  80  80  80  80  8		/ <b>*</b> \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	8.0"	
DOUBLE SAND, SOME SILT, FIRE CRAVEL AND WOOD FRAGMENTS — MOST)  S FILL: (VERY LOOSE BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'				<del> </del>  •
AND WOOD FRAGMENTS – MOIST)  S FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS – MOIST)  12.5  S FILL: (VERY LOOSE, BLACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT – MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'			MEDIUM SAND, SOME SILT, FINE GRAVE!	
10.0 5   S   FILL: (VERY LOOSE, BLACK FINE TO MEDIUM SAND, SOME SILT AND WOOD FRAGMENTS - MOIST)   SP			AND WOOD FRAGMENTS - MOIST)	sp   /           .
DEDITION SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  12.5  S FILL: (VERY LOOSE, B'ACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'				V
DEDITION SAND, SOME SILT AND WOOD FRAGMENTS — MOIST)  12.5  S FILL: (VERY LOOSE, B'ACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'		L _\s ∕₩!	FILL: (VERY LOOSE, BLACK FINE TO	
12.5 S FILL: (YERY LOOSE, B'.ACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL PEAT — MOIST)  BOTTOM OF BORING 14.0'  BOTTOM OF BORING 14.0'			MEDIUM SAND, SOME SILT AND WOOD	
12.5 S FILL: (VERY LOOSE, B'LACK FINE TO COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT — MOIST)  BOTTOM OF BORING 14.0'  BOTTOM OF BORING 14.0'			PRAGMENTS - MOIST)	<sup>39</sup>
COARSE SAND, SOME WOOD FRAGMENTS, FINE GRAVEL, PEAT - MOIST)  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING  14.0'  BOTTOM OF BORING	ļ	<u> </u>		
-4.4		12.5 s × 3	COARSE SAND SOME WOOD FRACTION	
-4.4   14.0   7		X K≪1;	FINE GRAVEL PEAT - MOIST)	
BOTTOM OF BORING 14.0'				3P
	-			
			BOTTOM OF BOSING	
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BORING NO. SB-2 SHEET 1 OF 1

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	DATE FIN	KISHED:	5- <b>3</b> -86		— Бол	RING NO.		<del></del>		اللكام	ENGIN	EER:	G. W. & D.	<del></del>
	GROUND	SURFACE	EL:	12.3'	_ N	F:				CHECK	KED 81	· _	D. HOLZMAN	
					_				•					
	ELEV. (FEET)	DEPTH (FEET)	SAMI	PROFILE	DE	ESCRIPTION		8080	(BL	RESIS OWS	TRATIO STANCE PER FO	: 20T)	REMARK	s
	6-3-86	<u>-</u>	-\s		FILL: (MEDIUM DEI MEDIUM SAND, TR FRAGMENTS AND	ACE SILT. BRI	CK	aw						<del></del>
	<u>    10.0                               </u>	2.5	S 2		MEDIUM DENSE, BF SAND, TRACE CLA	ROWN FINE TO Y — MOIST		sw						
		5.0	\$ 3		VERY SOFT, BROWN FINE SAND - MOIS	n silty clay, et	SOME	d						
		7.5	S 4		VERY SOFT, BROWN FINE SAND - MOIS	N SILTY CLAY, IT	SOME	d						
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BORING NO. MW-13 SHEET 1 OF 1

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		6-4-86							,		ENGN	EER.	G. H. & D. H. D. HOLZMAN
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·													
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-10.0	20.0	7	S CO/	Dium Dense, ARSE SAND,	REDDISH B SOME FINE	ROWN FIN GRAVEL	TO HOIST	sp					
	25.0	<i>,</i>							$  \   \  $				
PROJECT	NO. 501003		••						UNG N	ΪΠ			

SHEET 1 OF 2

DATE PIRENE: 8-4-98 GROUND SURFACE EL: 13.35'  BLEV DEPTH FITTH THE ENDISH BROWN FINE TO COARSE SAID, TRACE FINE TO COARSE SAID,		DATE BE	GAN:6-	-3-86		POPRIC NO									
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27.5  30.0  S VERY DENSE, REDDISH BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL - MOIST  BOTTOM OF BORING			-	-∤∖s/		VERY DENSE, REDDISH BROWN FINE TO	- 1				$\sqrt{}$				
27.5  30.0  VERY DENSE, REDDISH BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL - MOIST  BOTTOM OF BORING			<u> </u>	+X		coarse sand, some fine gravel - mo	IST				1				
- 30.0  VERY DENSE, REDDISH BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL - MOIST  BOTTOM OF BORING			-	- /8 \				-p			$\Lambda$		- 1		
- 30.0  VERY DENSE, REDDISH BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL - MOIST  BOTTOM OF BORING	Ì		- 275 -	<del>/ `</del>							7		- 1		
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BORING NO. MW-14 SHEET 2 OF 2

DATE BEGAN: DATE FINISHED:	6-5-86	BORING NO. MW-15		
GROUND SURFA	CE EL: 9.5'	N E	CHECKED BY:	1ULZMAN
ELEV. DEP (FEET) (FEE	TH SAMPLE TYPE	DESCRIPTION	Si PENETRATION SI RESISTANCE SI (BLOWS PER FOOT) D 10 30 50	REMARKS
2. - 2. - 5. - 7.!	5 5	FILL: (SOFT, RED CLAY, SOME CINDERS AND ASH - MOIST)  4.5  MEDIUM STIFF, RED CLAY; SOME SHALE FRAGMENTS - DRY	I COL	SAMPLE ECTED FROM O 6'.
		BOTTOM OF BORING 8.0°		

BORING NO. MW-15 SHEET 1 OF 1

GROUND SURFACE EL: 9.8' N E OLECKED BY: D. HOLZMAN GROUND SURFACE EL: 9.8' N E OLECKED BY: D. HOLZMAN  ELEV. DEPTH SAMPLE E DESCRIPTION G G HOLDWAY PROBLEM OF MESISTANCE (FEET) SAMPLE E DESCRIPTION G G HOLDWAY PROBLEM OF MESISTANCE (FEET) SAMPLE E DESCRIPTION G G HOLDWAY PROBLEM OF MESISTANCE (FEET) SOME GRAVEL - DRY BROWN FINE SAND. SP  FILL: (MEDIUM DENSE, BROWN FINE SAND. SP  SOME GRAVEL - DRY BROWN FINE SAND. SP  FRAGMENTS - MOIST 7.5' MI  VERY LOOSE, BLACK SULT, SOME SHALE AND BRICK SP  FRAGMENTS - MOIST 7.5' PI  VERY SOFT, BROWN TO RED SILTY CLAY - D  SOUTH FRAGMENTS - MOIST SHALE AND SHALE AND SHALE AND SHALE FRAGMENTS - MOIST SHALE SHALE FRAGMENTS - MOIST SHALE SHALE FRAGMENTS - MOIST SHALE SHALE FRAGMENTS - MOIST SHALE SHALE FRAGMENTS - MOIST SHALE SHALE SHALE FRAGMENTS - MOIST SHALE	DATE BEGAN: 6-3-86	BORING NO. MW-16	FIELD ENGINEER: G. H. & D. H.
ELEV. DEPTH TYPE E DESCRIPTION OF RESISTANCE (RICHMS PER FOOT)  STANDLE GRAVEL - DRY  FILL: (MEDIUM DENSE, BROWN FINE SAND. SP SO 50 SO SOME GRAVEL - DRY  SOME GRAVEL - DRY  FILL: (MEDIUM DENSE, BROWN FINE SAND. SP SO 50 SO SOME GRAVEL - DRY  SAND, SOME SILT, FINE GRAVEL AND BRICK SP FRAGMENTS - MOIST  7.5  VERY LOOSE, BLACK COARSE TO MEDIUM PLATE SOME CLAY - MOIST  7.5  VERY SOFT TO SOFT, BROWN TO RED SILTY CLAY - DRY  SOFT, RED CLAY, SOME SILT AND FINE SHALE RAGMENTS - MOIST  12.5  SOFT, RED CLAY, SOME SILT AND FINE DESCRIPTION DEPARTMENTS - DRY  MEDIUM STIFF, RED CLAY, SOME SHALE  15.0  DRILLING SPERAMENTS - DRY  DRILLING SPERAMENTS - DRY  DRILLING SPERAMENTS - DRY  MEDIUM STIFF, RED CLAY, SOME SHALE  17.5  18.5  -10.0  SET DENSE, BROWN FINE TO COARSE GRAVEL - SAND, ITRACE F			
SOME GRAVEL — DRY  SOME GRAVEL — DRY  SOME GRAVEL — DRY  SOME SULT, FINE GRAVEL AND BRICK  AND, SOME SULT, FINE GRAVEL AND BRICK  FRAGMENTS — MOIST  OLD  OLD  OLD  OLD  OLD  OLD  OLD  OL	GROUND SURFACE EL:	_ NE	
FILL: (MEDIUM DENSE, BROWN FINE SAND, 50  SOME GRAVEL - DRY  SOME GRAVEL - DRY  SP  PIECES OF WOO ENCOUNTERED  2.5  SP  FILL: (LOOSE, BLACK COARSE TO MEDIUM SP  FRAGMENTS - MOIST)  7.5  LILL  VERY LOOSE, BLACK SLT, SOME FINE GRAVEL - MOIST  7.5  SP  VERY SOFT, BROWN TO RED SILTY CLAY - SOME SHALE FRAGMENTS - MOIST  10.0  SS  SOFT, RED CLAY, SOME SILT AND FINE SHALE FRAGMENTS - DRY  MOIST  12.5  SP  MEDIUM STIFF, RED CLAY, SOME SHALE FRAGMENTS - DRY  115.0  DRILLING OPERATORS  OPERATORS  OPERATORS  TO SOME STAND  OPERATORS  OPERATORS  OPERATORS  OPERATORS  OPERATORS  OPERATORS  OPERATORS  TO SOME SHALE  OPERATORS  OPERATORS  TO SOME SHALE  OPERATORS  OPERATORS  OPERATORS  TO SOME SHALE  OPERATORS  OPERATORS  OPERATORS  TO SOME SHALE  OPERATORS  OPERATORS  TO SOME SHALE  OPERATORS  O	ELEV. DEPTH SAMPLE IL	DESCRIPTION	S RESISTANCE REMARKS
7.5   4   VERY LOOSE, BLACK SILT, SOME FINE GRAVEL — MOIST 7.5' Dt. VERY SOFT TO SOFT, BROWN PEAT, SOME QAY — MOIST 9.5' Dt. VERY SOFT BROWN TO RED SILTY CLAY — d MOIST SOFT, RED CLAY, SOME SILT AND FINE d SHALE FRAGMENTS — MOIST DRILLING OPERATIONS TEMPORARILY FRAGMENTS — DRY DENSE, BROWN FINE TO COARSE 12° PVC PIPE.  18.5'   VERY DENSE, BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL — MOIST   SW	6-4-86	SOME GRAVEL - DRY  3.5'  FILL: (LOOSE, BLACK COARSE TO MEDIUM SAND, SOME SILT, FINE GRAVEL AND BRICK	sp  PIECES OF WOO ENCOUNTERED ~2.5'.
15.0  DRILLING OPERATIONS TEMPORARILY ENDED ON 6-3-86 TO SEAT 12* PVC PIPE.  17.5  -10.0  20.0  S  VERY DENSE, BROWN FINE TO COARSE SAND. TRACE FINE TO COARSE GRAVEL - MOIST  SW  SW  DOI: 10.0  SW  SW  SW  SW  DOI: 10.0  SW  DOI: 10.0  SW  SW  DOI: 10.0  SW  SW  DOI: 10.0  SW  DOI: 10.0  SW  DOI: 10.0  SW  DOI: 10.0  SW  DOI: 10.0  SW  DOI: 10.0  SW  DOI: 10.0	0.0 10.0 5 S S S S S S S S S S S S S S S S S S	VERY LOOSE, BLACK SILT, SOME FINE GRAVEL — MOIST  VERY SOFT TO SOFT, BROWN PEAT, SOME CLAY — MOIST  VERY SOFT, BROWN TO RED SILTY CLAY — MOIST  SOFT, RED CLAY,, SOME SILT AND FINE SHALE FRAGMENTS — MOIST  MEDIUM STIFF, RED CLAY, SOME SHALE	pt d d
VERY DENSE, BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL - MOIST	15.0 15.0 17.5		OPERATIONS TEMPORARILY ENDED ON 6-3-86 TO SEA 12° PVC PIPE.
ROJECT NO. 501003	8 VE SA ME	TRY DENSE, BROWN FINE TO COARSE UND, TRACE FINE TO COARSE GRAVEL -	
	ROJECT NO. 501003	· ·	BORING NO. MW-16

٠ ¦	DATE BEGAN:6-3-86	BORING NO. MW-18	EEO CHOUSER C. H. & D. H.
	- DATE FINISHED: _6-4-86	_	FIELD ENGINEER: G. H. & C. H. CHECKED BY: D. HOLZMAN
	GROUND SURFACE EL: 9.8'	N E	CHECKED BY: U. HOLLMAN
	ELEV. (FEET) CEPTH SAMPLE IN TYPE OF CEPTH SAMPLE IN T	DESCRIPTION Si	(BLOWS PER FOOT) REMARKS
*		DENSE, BROWN FINE TO COARSE SAND, TRACE FINE TO COARSE GRAVEL - MOIST	

BORING NO. MW-16 SHEET 2 OF 2

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BORING NO. MW-17 SHEET 1 OF 1 REFERENCE NO. 15

# GEOLOGY AND GROUND-WATER RESOURCES OF UNION COUNTY, NEW JERSEY

By Bronius Nemickas

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations 76-73

Prepared in cooperation with

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL

PROTECTION, DIVISION OF WATER RESOURCES



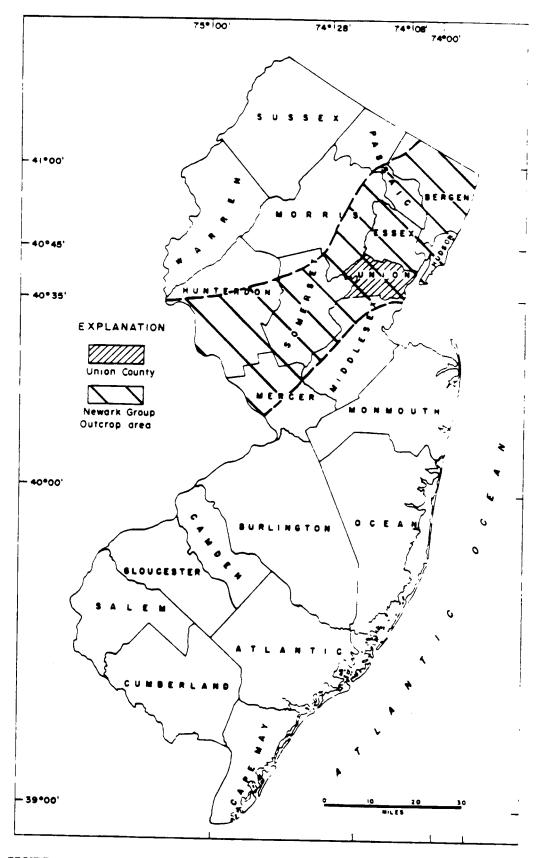


FIGURE 1. -- LOCATION OF UNION COUNTY AND OUTCROP AREA OF THE NEWARK GROUP.

# Methods of this Investigation

An inventory was made of public, industrial and domestic wells tapping the Brunswick Formation, Watchung Basalt and Pleistocene deposits. The well records are presented in Table 4 and well locations are shown in figure 2.

Geologic information was obtained from drillers' well logs and representative well logs are given in Table 6. A bedrock map on top of the Brunswick Formation and Watchung Basalt was constructed from well log information and is shown in figure 2. The thickness of the Pleistocene deposits can be determined from figure 2 by subtracting the bedrock elevation from the surface elevation.

Chemical analyses of ground water were made to identify the characteristic chemical and physical properties of the ground water in Union County. The chemical analyses of water samples from 59 wells are presented in Table 5 and their location is shown on figure 2.

# Acknowledgments

The author wishes to thank well drillers, State, municipal, and industrial officials, and private individuals who supplied data on which this report is based. Acknowledgment is made for the records and logs of wells that were furnished from the files of the New Jersey Bureau of Geology and Topography and to Elizabethtown Water Company for making the water quality analysis available to the author. The cooperation of many individuals who permitted the use of their wells for water-level observation and collection of water samples is gratefully acknowledged.

### **GEOGRAPHY**

# Topography and Drainage

Union County is in the Piedmont Plateau, one of eight major physiographic divisions of the United States. The major topographic features of the Piedmont Plateau in Union County are: (1) the Watchung Mountains, two basaltic ridges with maximum altitudes of about 550 feet, trending parallel to the northwestern boundary of the county; and (2) a gently rolling plain sloping from about 100 to 150 feet at the eastern side of the Watchung Mountains to sea level at Arthur Kill.

The Watchung Mountains extend from Passaic County through Essex and Union Counties and terminate in Somerset County. The ridges are underlain by thick sheets of basaltic lava flows intercalated with the shales and sandstones of the Newark Group. These ridges trend generally northeast-southwest and have steep, rock escarpments on the east and gentle slopes on the west.

Industrial Products	Number o	of Establishments
Chemicals and allied products		104
Fabricated metal products		226
Machinery, except electrical		275
Food and kindred products		71
Miscellaneous manufacturing		77
Printing and publishing		113
Furniture and fixtures		34
Instruments and related products		25
Textile mill products		14
Stone, clay, and glass products		26
Rubber and plastics products		63
<u>T</u>	otal 1	.,424

(New Jersey Department of Environmental Protection, 1967)

### **GEOLOGY**

### Newark Group

During the Late Triassic Epoch downfaulting produced a series of northeast-southwest trending basins in the Piedmont Plateau from Nova Scotia to North Carolina. Sedimentary and associated igneous rocks of Triassic age occupy the downfaulted basins and are known as the Newark Group. In New Jersey the Newark Group crops out in a band 16 to 30 miles wide trending northeast-southwest from the Delaware River to the Hudson River (fig. 1). Union County lies entirely within this band.

The Newark Group in New Jersey contains 15,000 to 20,000 feet of non-marine shales, mudstones, sandstones, conglomerates, and basic igneous rocks that unconformably overlie rocks of Paleozoic and Precambrian age. The sedimentary rocks of the Newark Group were largely derived from Paleozoic and Precambrian rocks to the southeast and deposited in a non-marine intermontane basin (Van Houten, 1965). During Triassic time the sedimentary rocks were intruded by a diabase sill, dikes, and covered by several flows of basalt.

The Newark Group underlying Union County consists of the Brunswick Formation and Watchung Basalt. The generalized geologic map (fig. 4) shows the areal distribution of the Triassic rocks underlying Union County. Figure 5 is a generalized section showing the geology and structure of Union County.

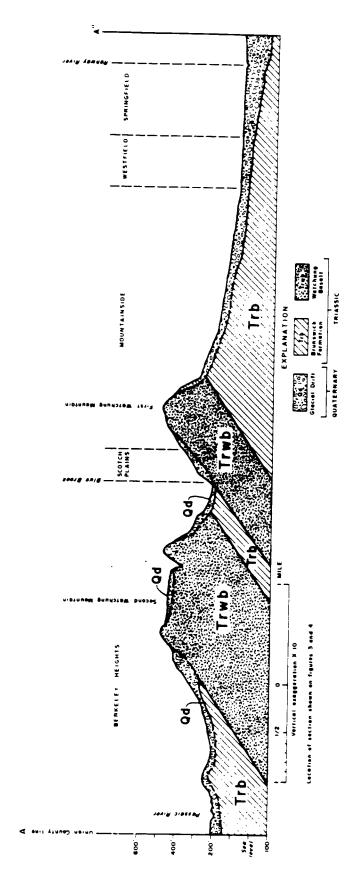


FIGURE 5. -- GENERALIZED GEOLOGIC SECTION ACROSS UNION COUNTY, NEW JERSEY.

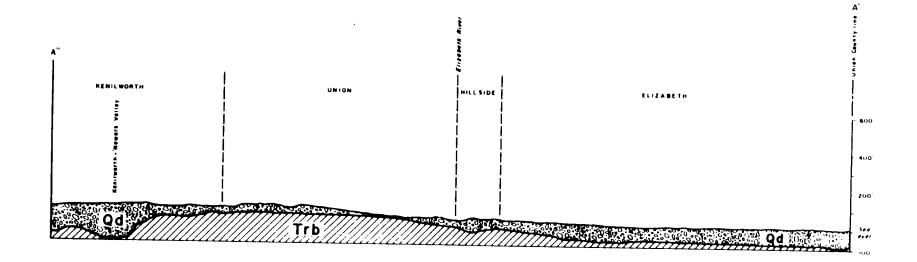


FIGURE 5. -- CONTINUED

The Brunswick Formation consists of thin-bedded shales, mudstones, and sandstones which range in color from reddish-brown to gray. The reddish-brown color originates from reworked hematite which comprises 5 to 10 percent of the formation (Boch, 1959). The minerals of the Brunswick Formation include quartz, illite, muscovite, feldspar. and small amounts of calcite and gypsum. Primary structures such as ripple marks and mud cracks indicate that the Brunswick Formation was deposited in a shallow-water environment.

The regional strike of the Brunswick Formation in Union County is N50°E with dips 9° to 13°NW. The major joint sets strike approximately N45°E and N75°W and both sets have a vertical dip. The thickness of the formation is 6,000 to 8,000 feet.

The Watchung Basalt consists of three extensive basaltic lava sheets that are intercalated with the sedimentary rocks of the Brunswick Formation. The basalt flows are more resistant to erosion than the shales, mudstones, and sandstones and form prominent ridges. Two of the three lava sheets occur in Union County and form the First and Second Watchung Mountains. The third sheet forms a discontinuous ridge known as Long Hill and Hook Mountain in Morris County to the west of Union County.

The basalt flows are volcanic extrusive rocks which were formed by the outflow of lava onto the land surface. Rapid cooling of the flows produced a dense, aphanitic rock. Phenocrysts are present in the ground mass which give the basalt a porphyritic texture. The phenocrysts are usually augite and in some cases feldspar. The ground mass for the most part consists of augite and feldspar.

The basalt sheets vary in thickness from less than 300 feet in parts of the Long Hill flow to a maximum of about 1,200 feet in parts of the Second Watchung Mountain. The Second Watchung Mountain is a double flow sheet separated by a thin section of the Brunswick Formation. The thickest flow sheet is the upper flow of the Second Watchung Mountain which has a maximum thickness of about 800 feet.

## Quaternary Deposits

Unconsolidated sediments deposited by glaciers or by glacial meltwater during the Pleistocene Epoch mantle the bedrock surface in Union County. These deposits consist of clay, silt, sand, gravel, and boulders. They are glacial, glaciolacustrine (deposited by glacial meltwater in lakes), or glacial fluvial (deposited by glacial meltwater in streams) in origin.

The Pleistocene sediments fall into three general classes: (1) end moraine--a moraine jointed across the course of a glacier at its farthest advance; (2) ground moraine--the material carried forward in and beneath the ice and finally deposited from its under surface; and (3) stratified

drift--deposits from glacial meltwater exhibiting both sorting and stratification. The stratified drift includes lacustrine (deposited in lakes) and fluviatile (deposited in streams) sands and clays.

Figure 3 is a surficial geologic map of Union County showing the extent of the end moraine, ground moraine, and stratified drift. West of the end moraine near Scotch Plains and Plainfield, stratified drift forms an outwash plain (fig. 3).

Before the last glaciation the rivers draining Union County cut deep valleys into the Brunswick Formation (fig. 2). Subsequently the valleys were filled and buried by glacial material. The thickness of the glacial deposits is controlled largely by the underlying bedrock topography. Figure 6 consists of three sections showing the altitudes of the bedrock valley floor and thickness of Pleistocene deposits in the bedrock valleys. These buried channels underlie parts of Hillside, Union, Springfield, Clark, and Scotch Plains Townships, and the Boroughs of Mountainside, New Providence and Kenilworth and the Cities of Summit and Rahway.

The Pleistocene sediments in the bedrock channels consist of unstratified and stratified clay, silt, sand, and gravel. Only the sand and gravel deposits of the stratified drift will yield large quantities of water to wells.

Deposits of Holocene (Recent) age cover only small areas and include river alluvium, and eolian deposits.

The stratigraphic units in Union County and their geologic and hydrologic characteristics are given in Table 1. Table 6 contains representative well logs indicating the variations in the lithologies of the geologic units.

### GROUND WATER HYDROLOGY

### Introduction

Water is continually being exchanged in a circulatory pattern between the earth and the atmosphere. In general, the amount of precipitation ultimately determines the amount of water available for man's use. Some of the precipitation that falls on land evaporates where it falls, some is absorbed by plants that later transpire the water back to the atmosphere, some flows overland to streams, and some infiltrates into the ground to become ground water. The ground water is discharged to streams, and streams flow to the oceans where the water can be evaporated back to the atmosphere.

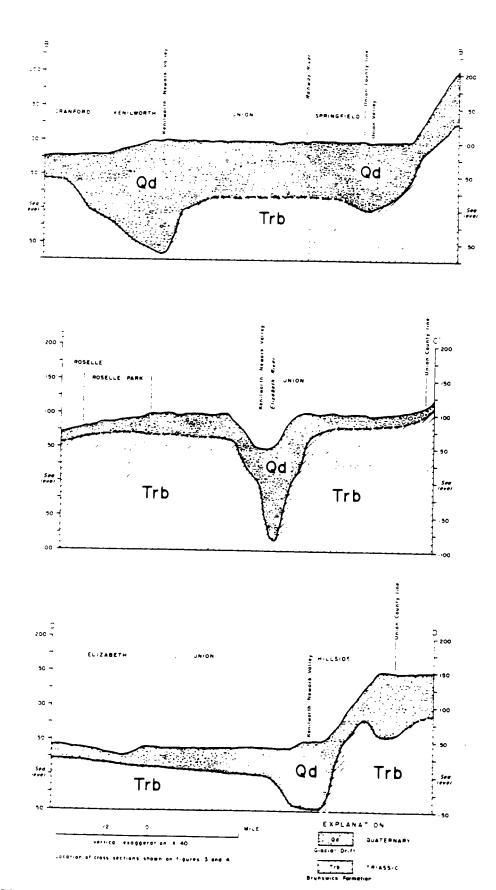


FIGURE p.--GEOLOGIC SECTIONS SHOWING THE BURIED CHANNELS IN UNION COUNTY, NEW JERSEY.

- 13 -

Table 1.--Geology and hydrology of the rock units in Union County, New Jersey

				rmation or	Thickness		
Era Period Series			li	thologic unit		Lithology	Hydrologic characteristics
		cene		alluvium	0-25	Sand, silt, and mud in and along river channels.	Relatively impermeable deposits; retard intrusion of saline water through river beds.
oic	Quaternary	Holocene		eolian deposits	0-10	Sand	Above water table; high rate of infiltration.
Cenozoic	Quate	stocene		un- Stratified drift (till)	0-200	Unstratified clay, sand and gravel; reddish brown in color. Forms the ground and end moraine deposits.  Deposited by glaciers.	Because of low permeability, it is not an important aquifer in the County.
		Pleis		stratified drift	0-60	Sand and gravel lenses which are stratified. Occurs as lenses in the till in the bedrock channels and interbedded with till in the end moraines. Deposited by water.  Unconformity	Important as an aquifer in the City of Rahway and in Union, Hillside and Springfield Townships and in Kenilworth Borough. At the City of Rahway and Hillside Township wells induce recharge from rivers.
J	U	Triassic	Group	Brunswick Formation	6,000-8,000	Interbedded, soft red shales, mudstones, and sandstones. Adjacent to the Watchung Basalt it is altered to a hornfels.	Most extensive and most important aquifer in Union County. Water stored in and transmitted along tracture and joint systems which decrease in number and volume with depth. Both artesian and water-table conditions exist.
Mesozoic	Triassic	Upper I	Newark	Warchung Basalt	300-800	Basaltic lava sheets intercalated with the sedimentary rocks of the Newark Group. Two of the sheets crop out in Union County. The basalt is a dense, aphanitic, extrusive rock. Augite and feldspars are the chief minerals.	Minor aquifer in the county. Well yields are low to moderate.

The hydrograph of the Hillside well No. 27 (fig. 7B) shows seasonal water level fluctuations due to pumpage in the area. The general lowering of water levels from 1953 to 1961 is a result of increased pumpage. The increased rate of water level decline from 1961 to 1965 is also attributed largely to below-average precipitation. Hydrographs of the remaining six observation wells in Union County show no significant decline in water levels during the period 1956 to 1968. The hydrograph (fig. 7C) of one of these wells tapping the Brunswick Formation, Elizabeth No. 1, shows a rise in water levels from about 1963 to 1968. This rise is believed to be the result of decreased pumpage from nearby wells. However, no data are available to indicate such changes in pumpage.

The water table generally rises from the end of October to the middle of April, a period when evapotranspiration is at its lowest (fig. 8). The decline of water levels as shown by the hydrograph of Kenilworth well No. 4 indicates that discharge exceeds recharge from April through October when evapotranspiration is at its highest (fig. 8). The ground-water level decline is accompanied by decreasing stream runoff (fig. 8). The decline in stream runoff is partly controlled by the decreasing water-table gradient. The decrease in overland flow to streams in spring and summer also decreases total runoff, because most of the precipitation either evaporates or infiltrates the soil, where it is transpired by plants.

# Hydrologic Properties of Rocks

Porosity is the ratio of the volume of pore space in a rock to its total volume and is expressed as a percentage. Porosity includes both primary openings such as intergranular pore space in the Pleistocene deposits and secondary openings such as joints and fractures in the Brunswick Formation and Watchung Basalt.

The permeability of a rock is its capacity to transmit water. The coefficient of permeability is the rate of flow of water, in gallons per day through a cross-sectional area of 1 square foot under a hydraulic gradient of 1 foot per foot at a temperature of 60°F.

The coefficient of transmissibility of an aquifer is the rate of flow of water, at the prevailing water temperature, in gallons per day, through a vertical strip of the aquifer 1 foot wide extending the full saturated height of the aquifer under a hydraulic gradient of 100 percent.

The storage coefficient of an aquifer is the volume of water in cubic feet discharged from each vertical column of the aquifer with a base of 1 foot square as the water level falls 1 foot.

In field practice, the coefficient of transmissibility and storage are usually determined by aquifer tests, and the coefficient of permeability is computed by dividing the transmissibility by the saturated aquifer thickness.

The specific capacity of a well, the rate of yield per unit draw-down for some time interval, generally gallons per minute per foot of drawdown, can be a good measure of the transmissibility of the rocks. High specific capacities generally suggest a high coefficient of transmissibility, and low specific capacities generally suggest a low coefficient of transmissibility. However, specific capacity also is affected by the coefficient of storage, the thickness and boundary conditions of the aquifer penetrated by the well, and development and construction of the well.

For a more complete discussion of general ground-water hydraulics, the reader is referred to Theis (1935, p. 519-524), Ferris (1949, p. 226-272), Todd (1959, p. 77-114), DeWiest (1965, p. 161-183), and Davis and DeWiest (1966, p. 156-374).

# Water-bearing Properties of Major Rock Units

### Newark Group

# Brunswick Formation

The Brunswick Formation of Late Triassic age is the major aquifer in Union County and underlies most of the county. Water in this formation occurs in joints and fractures. These joints and fractures become progressively tighter and fewer with increasing depth below land surface. Only moderate quantities of water can be stored or transmitted in these fractures.

Ground water occurs under both unconfined and confined conditions in the Brunswick Formation. Unconfined ground water occurs mainly in the upland areas where overlying unconsolidated sediments are thin or absent. In the lowland areas in the southern and eastern part of Union County the rocks are mantled by unconsolidated Pleistocene deposits that, in most places, contain silt and clay beds. In the lowland areas the silt and clay beds may confine water in the underlying rocks. Wherever such confinement occurs, water beneath the impermeable layers is under artesian pressure. In a few areas the artesian head is above land surface resulting in flowing wells. Locally, artesian conditions result from differences in permeability within the rock layers caused by varying degrees of fracturing, or weathering, or a combination of both.

Several pumping tests have been conducted on wells tapping the Brunswick Formation in Union County. The coefficient of transmissibility determined from five of these tests ranged from 5,900 to 25,400 gpd per ft; most of the values lie between 15,000 and 25,000 gpd per ft. The average coefficient of storage computed from these tests is about 0.00005.

Results of pumping tests indicate that the Brunswick Formation is anistropic; that is, its ability to transmit water is not equal in all directions. The greatest drawdowns caused by pumping are observed in wells aligned along the strike of the beds with respect to the pumping well. The smallest drawdowns are observed in wells aligned transverse to the strike (Vecchioli, 1967). These pumping test observations have been interpreted to indicate that joints and factures which strike parallel to the strike of the bedding are better developed and interconnected than joints and fractures which strike in other directions. Therefore, minimum interference between pumping wells in well fields tapping the Brunswick Formation can be achieved by aligning the wells across the strike of the beds rather than parallel to the strike.

The average reported yield of 230 public-supply, industrial, and commercial wells (table 4) tapping the Brunswick Formation is 200 gpm; yields range from 12 to 870 gpm. A better indication of the potential yield of properly located and developed wells tapping the Brunswick Formation can be obtained from analysis of yields of large diameter (10 inch or greater) wells. The large diameter wells, generally the deeper wells, represent attempts to develop the maximum supply of water. The average yield of 109 large diameter wells (table 4) is 310 gpm; yields range from 23 to 870 gpm.

The distribution of well yields is as follows:

Yield (gpm)	230 Wells	109 Large Diameter Wells
0 - 50	18	2
51 - 100	42	9
101 - 150	36	8
151 - 200	32	14
201 - 250	25	10
251 - 300	20	13
301 - 350	16	15
351 - 400	10	7
401 - 450	6	6
451 - 500	9	9
501 - 550	10	10
551 - 600	2	2
600	4	4

Figure 9 shows the cumulative frequency distribution of reported yields of wells in the Brunswick Formation. It can be seen on the graph that 50 percent of the 230 wells have yields equal to or less than 180 gpm; 50 percent of the large diameter wells have yields equal to or less than 300 gpm. Many of the higher yielding wells occur where the Brunswick Formation is overlain by relatively thick, saturated glacial deposits that readily pass water downward into the fractures in the Brunswick Formation.

The specific capacities of 205 wells (6 to 12 inches in diameter) in the Brunswick Formation range from 0.04 to 25 and average 3.5 gpm per foot of drawdown; 14 of the wells have specific capacities greater than 10 gpm per foot of drawdown. The depths of the wells range from 100 to 1,108 feet and average 387 feet.

Figure 10 is a cumulative frequency distribution graph of specific capacities of wells tapping the Brunswick Formation in Union County. In figure 10, specific capacities are related to the well diameter. The larger diameter wells have the higher specific capacities. Median specific capacities are 1.7 for 6 and 8-inch diameter wells, 2.0 for 10 inch diameter wells and 3.1 for 12 inch and larger diameter wells. The higher specific capacities in the larger diameter wells can be attributed to better well development, well site selection and decreased well entrance losses.

In table 2, specific capacities are listed in percentile on the basis of depth of well drilled below land surface. In order to minimize the effect of well diameter on specific capacity, separate listings for larger and smaller diameter wells are given. Wells between 200 and 600 feet deep, in general have higher specific capacities than wells of shallower or greater depths. This relationship suggests that the best water-producing zones in the Brunswick Formation are encountered between depths of 200 and 600 feet. Below 600 feet the fractures and joints are less enlarged and generally drilling to greater depths will not produce significantly greater well yields.

Wells tapping the Brunswick Formation generally draw water from several water-bearing zones. In areas where the rocks are exposed or covered by a thin layer of unconsolidated sediments the shallow water-bearing zones contain unconfined water to a depth of about 200 or 300 feet. If wells penetrate to depths between 200 and 600 feet one or more confined zones of greater permeability are intercepted. The wells that are drilled between 200 to 600 feet in general have the greatest yields.

#### Watchung Basalt

The Watchung Basalt is a minor aquifer and underlies the western edge of Union County. In this formation vesicles add primary porosity to the secondary porosity developed from the joints and fractures. However, all these openings constitute only a small part of the total volume of the basalt and their capacity to store and transmit water is poor.

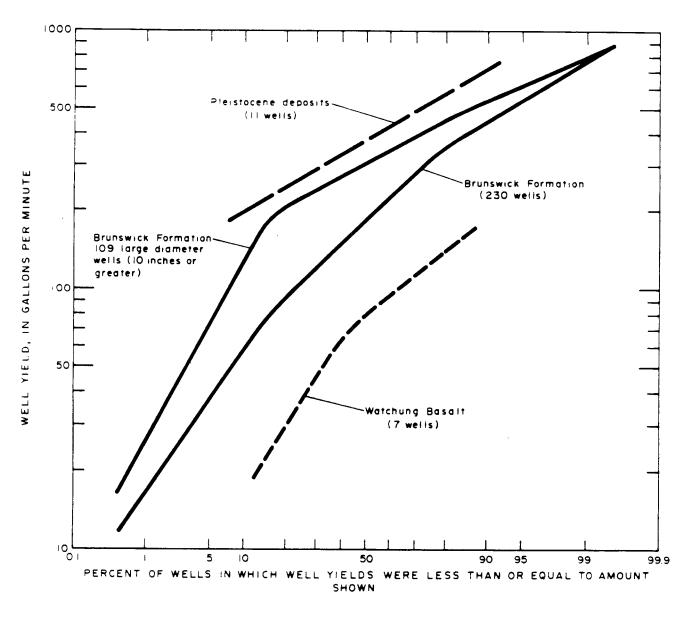


FIGURE 9.--CUMULATIVE FREQUENCY DISTRIBUTION OF YIELDS OF WELLS
PENETRATING THE BRUNSWICK FORMATION, WATCHUNG BASALT
AND PLEISTOCENE DEPOSITS.

Wells tapping the Watchung Basalt produce small to moderate quantities of water. Reported yields of seven industrial and commercial wells (Table 4) range from 20 to 164 gpm and average 85 gpm. The distribution of the yields is as follows:

Yields (gpm)	Number of Wells
0 - 50	2
51 - 100	3
101 - 150	1
151 - 200	1

高いない こうかん

It can be seen on the cumulative frequency distribution graph (fig. 9) that 50 percent of the wells have yields equal to or less than 80 gpm.

Specific capacities of the wells in the basalt range from 0.24 to 2.5 and average 1.23 gpm per foot of drawdown.

#### Pleistocene Deposits

Only sand and gravel aquifers of the stratified drift contain sufficient quantities of water to warrant consideration of their water-bearing properties. The most productive artesian and semi-artesian aquifers of the stratified drift in Union County occur as valley-fill deposits in channels that were cut into the bedrock before the last glaciation.

Areas of greatest thickness of valley-fill material and the altitude of the deepest bedrock valleys are shown below.

Valley Kenilworth-	Location	Thickness of valley-fill material (feet)	Altitude of bedrock channel bottom (feet)
Newark Valley	Newark	230	-220
	Hillside	102	-52
	Union	131	<b>-</b> 78
	Kenilworth	180	-90
Summit Valley	Summit-New Providence	223	+17
Union Valley	Union- Springfield	91	-3
Rahway	Rahway	56	-26
	Scotch Plains	70	-10

REFERENCE NO. 16

#### II. HYDROGEOLOGY OF MIDDLESEX COUNTY

#### A. Background

Middlesex County lies within two major physiographic provinces - the Atlantic Coastal Plain and the Piedmont Province. That portion of the County west of the Lawrence Brook and north of the Raritan River are generally within the Piedmont Province while the remainder of the County is within the Atlantic Plain. That portion within the Piedmont Province is generally characterized by clay and shale formations with relatively high surface runoff rates while the Coastal Plain is characterized by sand and gravel formations along with a higher infiltration rate. The topography of the County is generally level or rolling with maximum elevations of approximately 240 feet in the southwestern part of South Brunswick Township. mainder of the County averages some 100 feet in elevation. The lowest elevations approach sea level at the tidal areas on Raritan Bay and at the mouth of the Raritan River. As a result of its natural topography and its proximity to Raritan Bay the County contains numerous natural drainage ways the majority of which drain to the mainstem of the Raritan River and into Raritan Bay. Several streams in the eastern area of the County drain directly to the Raritan Bay and several in the northeastern portion of the County are tributaries of the Rahway River or drain directly to the Arthur Kill (See Figure 1).

Middlesex County's climate is described as temperate with the average annual temperature between 50°F and 55°F. January and February are the coldest months having a mean temperature of 32°F with July the warmest month having a mean temperature of 75°F. Water temperatures follow a similar pattern, also ranging from 32°F to 75°F. Prevailing winds are from the northwest during the winter months and from south to southwest during the warmer months.

The average annual precipitation within the County is approximately 44 inches with February having the lowest monthly average and July the highest. The period from May to September has the highest average rainfall. Annual snowfall averages between 20 and 30 inches. Complete precipitation and temperature data for the New Brunswick meteorological station are shown in Table 2 on the following page.

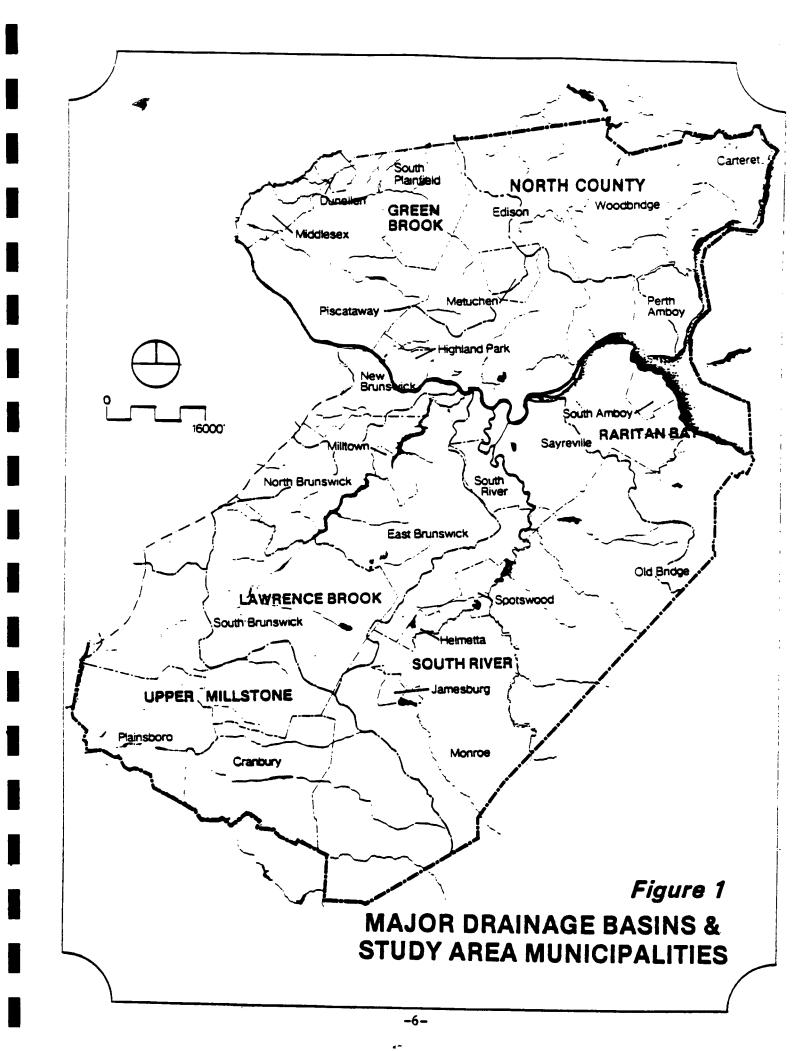


TABLE 2

Average Precipitation and Temperature
At New Brunswick, N.J.

<u>Month</u>	Precipitation <sup>1</sup> (inches)	Temperature <sup>2</sup>
January	3.25	31.2
February	2.96	32.8
March	3.59	40.6
April	3.47	51.6
May	3.77	61.4
June	3.67	70.2
July	4.89	74.9
August	4.73	73.1
September	3.68	6 <b>6.</b> 7
October	3.22	<b>36.5</b>
November	3.16	45.6
December	3.26	33.9
Annual Average	43.65	53.20

#### B. Hydrogeology

Geologic sequence in Middlesex County is listed in Table 3 with those formations which are both sufficiently thick and important County water supply sources highlighted. A generalized northwest-southeast cross section from the Stelton to Runyon areas shown in Figure 2.

The areal extent of major aquifer recharge areas in Middlesex County have been identified in Figure 3. These are the locations where water bearing geologic formations are at the surface or have a water permeable ground cover. These recharge or outcrop areas provide the majority of the water to the wells drilled to the aquifers. It is estimated that there are more than eight thousand wells tapping groundwater in Middlesex County. The largest majority of these wells are of low capacity and are used primarily for domestic purposes, however, 293 wells can each produce at least 100,000 gallons per day<sup>3</sup>.

The two distinct aquifer formations that provide the largest portion of the groundwater in Middlesex County are the unconsolidated sand and gravel of Upper Cretaceous Age and the consolidated rocks of Triassic Age. The principal sources of groundwater in order of their importance are: the Old Bridge Sand and Farrington Sand aquifers of the Raritan Formation, the Brunswick shale of Newark Group (Triassic formation) and the Undifferentiated Sands of Upper Cretaceous Age. Although more water is drawn from the Newark Group than from the Undifferentiated Sands and Englishtown Sand, Newark Group rocks are not as uniformaly reliable as the Cretaceous Sand.

A detailed discussion of the geologic and hydrologic characteristics of each strata is provided in the report by Henry C. Barksdale et. al $^4$ . In

#### TABLE 3

## Hydrostratigraphic Sequence in Middlesex County 5

Cenozoic Sequence
Quarternary System
Recent Series
Alluvium
Eolin deposits
Pleistocene series
Wisconsin drift
Cape May formation
Pensauken formation

#### Unconformity

Mesozoic Sequence Cretaceous System Upper Cretaceous series Mount Laurel and Wenonah Sands Marshalltown formation Englishtown sand Woodbury clay Merchantville clay Magothy formation Raritan formation Amboy stoneware clay Old Bridge sand South Amboy fire-clay Sayreville sand Woodbridge clay Farrington sand Raritan fire-clay

#### Unconformity

Triassic System.

Upper Triassic series (Newark group)

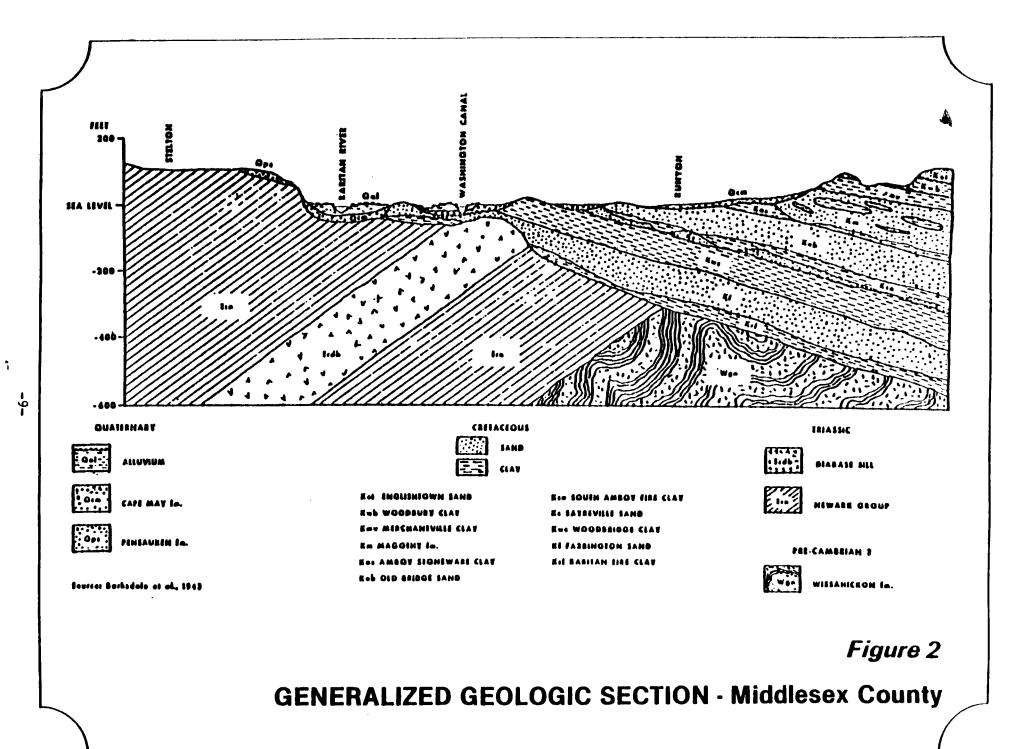
Brunswick shale

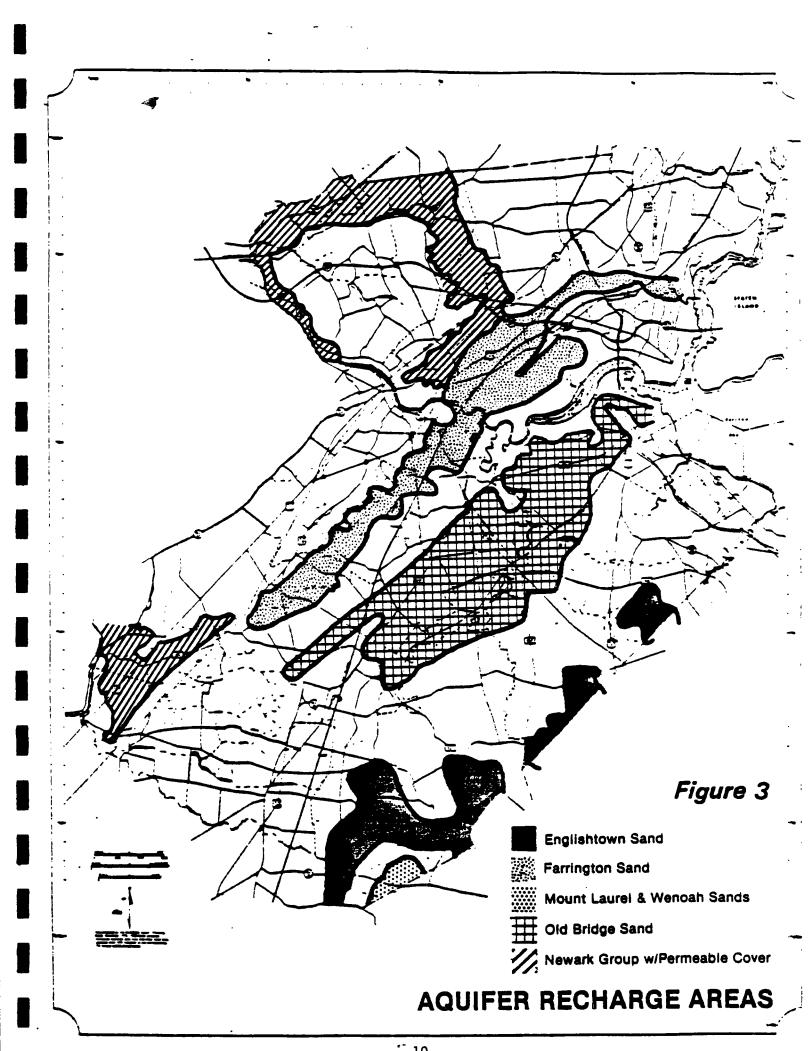
Lockatong formation

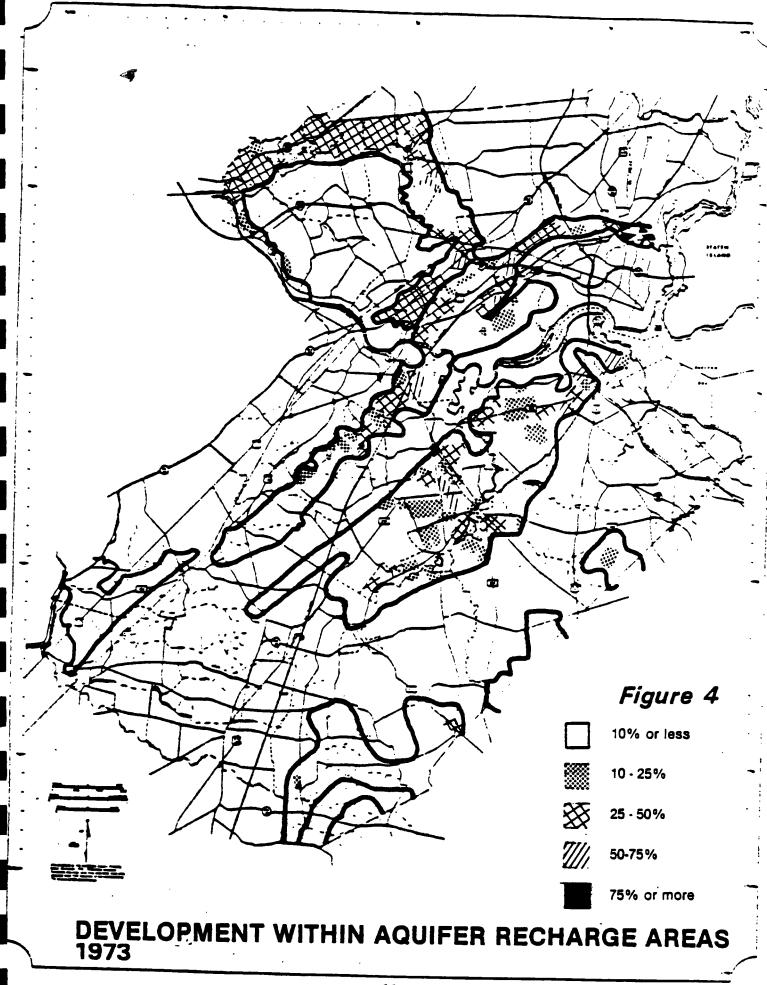
Stockton formation

#### Unconformity

Proterozoic Sequence Pre-Cambrian Wissahickon formation







this study an attempt has been made to evaluate and summarize the geologic characteristics of the rocks as they relate to their water carrying and water producing capacity.

#### C. Quarternary System

#### 1. Wisconsin Drift

The Wisconsin Drift was deposited by the last four continental ice sheets of the Pliestoncene Age which covered large portions of the northern United States. It forms a nearly continuous mantle over the underlying Triassic and Cretaceous rocks in the northeastern part of Middlesex County. The southern limit reached by the Wisconsin glacier in Middlesex County is roughly along a line from Plainfield to Metuchen and over to the mouth of the Raritan River at Perth Amboy. The Wisconsin Drift is of importance from a water supply standpoint primarily because some portions are permeable enough to absorb water directly from precipitation and transmit it readily into underlying beds.

The outwash plain found between Metuchen, Plainfield and east Bound Brook covers an estimated 16 square miles and consists of layers of sand and gravel which together are called stratified drift. The stratified drift is approximately 10 to 60 feet thick on the eastern edge near the moraine. In general the stratified drift is quite permeable but it is too shallow and covers too small an area to be in itself an important water supply source. However, it holds water which percolates into the underlying Brunswick formation and has increased the yield of many wells located on the drift.

#### 2. Cape May Formation

The Cape May formation is a pinkish-yellow fine to medium grained quartz sand forming a thin mantle 3 to 10 feet thick over the Cretaceous formation in the South River valley as well as along the south shore of the Raritan River.

The average porosity of the Cape May formation is 43% and the average specific yield is 38%. The coefficient of permeability ranges between 180 to 900 with a weighted average of 450. A block of Cape May Sand one square mile in area and one foot thick is capable of storing approximately 80 million gallons of water.10

The important hydrologic feature of the Cape May formation is that it overlies the Old Bridge Sand aquifer and increases its recharge capacity. No major water supplies are drawn directly from the Cape May formation at the present time.

#### 3. Pensauken Formation

In the southern portion of Middlesex County most of the hills and upland areas (above 60 feet elevation) are covered with a layer of yellow to brown, clayey sand and gravel known as the Pensauken formation. The largest

area is between the Lawrence Brook and South River extending southwest to Cranbury. The Pensauken formation in this area is of importance in that it covers the truncated sand members of the Raritan formation.

The Pensauken formation ranges in thickness to 70 feet with the average porosity and specific yield estimated to be 40% and 30% respectively. The coefficient of permeability is considerably less than the Cape May formation, ranging between 120 and 200 and averages approximately 170. A block of the Pensauken formation 1 square mile in area and 1 foot thick could store an estimated 64 million gallons of available water.

No large water supplies have been developed from the Pensauken formation however it does yield small supplies of water to a large number of wells for domestic and farm use. Its importance from an hydrologic standpoint is in that it readily absorbs water from precipitation and transmits it to underlying aquifers resulting in an increase in the effective recharge area. Much of the intake area of the Farrington Sand and a portion of the intake area of the Old Bridge Sand is overlain by the Pensauken formation.

#### D. Cretaceous System

#### 1. Englishtown Sand

The Englishtown Sand occurs near the southeastern border of the County and is a fine to medium-grained white or yellow sand which is occasionally micaceous, lignitic and limonitic. The Englishtown Sand in Middlesex County is approximately 100 feet thick and is overlain by the relatively impermeable Marshalltown formation.

Physical properties of the formation vary widely. The weighted average coefficient of permeability is 525 with the average porosity 44% and specific yield 30%. On the basis of the physical properties and the performance of wells tapping this resource in Monmouth County, the Englishtown Sand is in all probability the third most productive Coastal Plain in Middlesex County. At the present time however, no large water supplies have been developed from this formation in Middlesex County because of its relatively remote location from population and industrial centers. It should be noted that the Englishtown Sand is the second major source of water supply to Monmouth County. A number of wells in this formation yield more than 0.5 mgd. It is possible to develop a water supply of approximately 5.0 million gallons per day from this source in the County.11

#### 2. Magothy-Raritan Formations

Although the Magothy and Raritan formation are distinct geologic units, they are frequently in direct hydraulic contact and are considered part of the same aquifer system. Northeast of Jamesburg, the Raritan formation has been divided into seven members, three of which are water bearing. Even though it is possible to divide the Raritan formation into seven distinct

members, attempts to trace recognized units in the outcrop areas, both along the strike and downdip, have been only moderately successful. 12 Hydrogeologic characteristics of units in Raritan formation have been summarized in Table 4.

#### 3. Magothy Formation

The Magothy formation lies immediately above the Raritan formation and is separated from the Old Bridge Sand member by the Amboy Stoneware Clay. Average porosity of the Magothy formation is 46% and specific yield is approximately 41%. The coefficient of permeability ranges between 60 and 925 with a weighted average of 296. A block of Magothy formation one square mile in area and one foot thick can store 85 million gallons of water.

While the Magothy formation is capable of storing large quantities of water it does not transmit it freely due to its low coefficient of permeability. At the present time no significant supply of water is drawn from this formation although numerous wells for domestic and agricultural uses draw water from this source. Due to its low permeability and transmissivity, successful development of large capacity wells in the Magothy formation would be difficult if not impossible to accomplish.

#### 4. Old Bridge Sand

The Old Bridge Sand member of the Raritan formation is the most productive and intensely developed aquifer in Middlesex County. It outcrops or is exposed beneath permeable Pliestocene deposits in an irregular band that extends from Raritan Bay near South Amboy to and probably beyond Jamesburg. It has an intake area of approximately 25 square miles, a thickness of 80 to 110 feet and dips gently to the southeast at 40 to 45 feet per mile.

The Old Bridge Sand is well sorted and is composed of fairly fine to coarse sand or fine gravel. The average porosity of the Old Bridge Sand is estimated to be 42% and specific yield is 40%. The coefficient of permeability ranges between 1000 and 1500. The Old Bridge Sand is capable of storing and transmitting large quantities of water; for example, a block of Old Bridge Sand one square mile in area and one foot thick would store about 84 million gallons of available water. The sand can transmit approximately 1 mgd for each square mile of aquifer.13

#### 5. Farrington Sand

The Farrington Sand outcrops in a contiguous band nearly a mile wide along the southeast edge of Farrington Lake in East Brunswick. It has a total outcrop area of approximately 22.3 square miles, of which 10.9 square miles lie south of the Raritan River and 11.4 square mile lie north. The effective recharge area of the Farrington Sand is 16.9 square miles and has an average thickness of 80 feet, dipping gently to the southeast at the rate of 45 to 55 feet per mile.

The Farrington Sand is a medium to coarse grained sand with an average porosity estimated at 34% and specific yield 32%. The coefficient of permeability ranges between 210 and 3500 with a weighted average between 1,200 and 1,500. The Farrington Sand is also capable of storing and transmitting large quantities of water. A block of the Farrington Sand one square mile in area and 1 foot in thickness would be capable of storing almost 67 million gallons of available water. It can transmit more than 2.5 mgd for each square mile of aquifer.14

#### E. Triassic System

#### 1. Newark Group

The rocks of the Newark Group are the third most important aquifer in the County (behind the Old Bridge Sand and Farrington Sand) because of their areal extent and large amount of water developed from them. The oldest is the Stockton formation consisting of conglomerate and sandstone interbedded with red shale. Next oldest is the Locatong formation consisting of hard shale and argullite. The two rocks are found in a small area near the southwestern-border of the County. The Brunswick formation is a red shale interbedded with siltstone and occassional layers of sandstone and covers the entire area north of a line between Carteret and Plainsboro.

These formations are rather impermeable except along numerous cracks which traverse the beds at high angles to the bedding. Some water may flow along the bedding planes but such movements are limited. These rocks dip to the northwest at angles ranging from 50 to 150

The fact that these rocks are usually fine grained, relatively impermeable and are water bearing by virtue of their cracks and crevices, introduces problems in any attempt to appraise their water bearing capacity. The permeability and specific yield of the Newark Group depends upon the degree of cracking. Since the degree of cracking decreases with the depth, the permeability and specific yield also decreases with the depth. The cracks in the rocks of the Newark Group intersect one another at many angles; the result being that water can move almost in any direction. Figure 3 shows the area of the Brunswick formation covered with permeable material to a thickness of 40 to 45 feet.

The coefficient of transmissibility of the Brunswick Shale is approximately 25,000 (as compared to 96,000 for the Farrington Sand and 108,000 for the Old Bridge Sand) and the storage coefficient is approximately 0.0044.15 This means that Farrington and Old Bridge Sands can transmit four times as much water as the rocks of Newark Group under a given hydraulic head and through a given width of section. The difference in the capacity of the Newark Group to store water is even more striking. For one square mile area and 300 feet of saturated thickness Newark Group rocks would hold only 275 million gallons of water. By comparison 80 feet of the Farrington Sand would hold 5,360 million gallons of water for the same area. The low storage capacity explains the high rate of runoff and low ground water flows observed in streams draining areas underlain by Newark Group formations where there is no permeable cover material.

#### HYDROGEOLOGIC CHARACTERISTICS OF UNITS OF THE RARITAN FORMATION -MIDDLESEX COUNTY

#### Physical Properties

Unit	Lithologic Description	Average Porosity (percent by volume)	Permeability <sup>1</sup>	Kemarks 👍
Amboy Stoneware Clay	Light-gray to nearly black clay; abundant carbonaceous materials; locally has mottled red appearance; in some places gray to black sandy clay; Lignitic. Thickness to 30 feet.	-	_	An aquiclude <sup>2</sup>
Old Bridge Sand	White to light-yellow, fine to medium grained, occasionally coarse grained, slightly micaceous sand; locally contains thin, irregular clay beds. Thickness 80 to 110 feet. Dips southeast 40 to 45 feet per mile.	40	1000 - 1500	Most productive aquifer in the Raritan Formation and the County. Effective in- take area is 33 square mile
South Amboy Fire Clay	Varicolored light-gray, white or brick-red clay; locally sandy. Thickness to 35 feet.	-	<del>-</del>	An aquiclude
Sayreville Sand	Layers of fine white micaceous sand, fine to coarse grained white sand, with or without clay and arkosic sand beds. Usually thin and lacks continuity. Thickness to 40 feet.	44	30 - 500	Owing to thinness and lack of continuity, this sand member is unimportant as an aquifer. So far as known, no wells in this area draw water entirely from this aquifer.
loodbridge Clay	Dark-gray clay to sandy clay and clayey sands. The basal part is varicolored white, light-gray, and brick-red compact clay. Thickness 50 to 100 feet.	<u>-</u>	-	An aquiclude
arrington Sand	Light-gray or light-yellow, fine to medium grained sand grading into coarse arkosic sand sprinkled with small pebbles and gravel in the lower part. This sand is commonly divided by clay layers into two or more parts. Thickness 35 to 135 feet. Dips southeast 55 feet per mile.		1200 - 1500	Second in importance as a productive aquifer to the Old Bridge Sand. Total intake area is 17 square miles.
laritan Pire Clay	Varicolored blue, grown, gray or red clay. Basic component has brick-red color. Thick- ness to 90 feet.	-	-	An aquiclude

Note: Summarized from "The Groundwater Supplies of Middlesex County, N.J." Henry C. Barksdale, et. al., State Water Policy Commission, Special Report

-16-

<sup>1</sup> Coefficient of permeability is the rate of flow of water in gallons per day through a cross sectional area of one square foot under a hydraulic gradient of 100% at the prevailing temperature.

<sup>2</sup>A geologic formation, although porous and capable of absorbing water slowly, will not transmit it fast enough to turnish an appreciable supply

#### F. Groundwater Recharge

#### 1. Natural Recharge

As was previously stated the Old Bridge Sand is the most productive aquifer in Middlesex County and may be the most productive in New Jersey. On the whole the intake area of the Old Bridge Sand is exceptionally well suited for absorbing water from precipitation and streamflow and transmitting it to the water table. It outcrops in an irregular band that extends from the Raritan Bay near South Amboy to and probably beyond Jamesburg. take area south of Jamesburg is deeply covered by the Cape May and Pensauken formations which themselves are quite porous and absorb and transmit water readily. Where it has been defined and mapped the intake area is approximately 25 square miles with the effective intake area estimated to be some 33 square miles. 16 Over much of the intake area the land surface is relatively flat, hence water doesn't run off rapidly and instead has an opportunity to percolate into the ground. The sandy nature of the soil reduces the losses by direct evaporation from soil. The vegetation on the soil is not very rank so that evapo-transpiration losses are only moderate. The Farrington Sand is, for much of its area, overlain by permeable soils having excellent drainage which in turn allows for natural recharge.

Henry C. Barksdale estimated that 20 inches of precipitation are available annually for recharging the Old Bridge and Farrington Sands. 17 This is approximately 950,000 gallons/day/square mile. On this basis total natural recharge of the Old Bridge Sand would be 31.35 mgd for an effective intake area of 33 square miles. Natural recharge for the Farrington Sand, for an effective intake area of 17 square miles, would be approximately 16.2 mgd.

It is difficult to estimate natural recharge rate for the undifferentiated Magothy-Raritan formation due at this time to the lack of a detailed investigation. However, while the Magothy formation is capable of storing large quantities of water, it does not generally transmit it freely. This means that recharge rates would be much lower than has been estimated in Middlesex County's Comprehensive Master Plan. 18 Inference from hydrogeological properties leads us to believe that the natural rate of recharge for the Undifferentiated Magothy-Raritan formation is approximately half of the Old Bridge and Farrington Sands or about 0.5 mgd/square mile.

#### 2. Artificial Recharge

As a means of increasing the supply of groundwater, attempts have been made to use man-made groundwater recharge basins. Artificial recharge is defined as augmenting the natural infiltration of precipitation or surface water into underground aquifers by artificially changing natural conditions to allow water to recharge. A variety of methods have been developed, including increasing the extent of water recharge ponds, recharging through pits excavations, wells and shafts and pumping to induce recharge from surface water sources. The choice of a particular method is governed by local topographic, geologic and soils conditions, the quantity of water to be recharged and ultimate water use.

Recharge ponds are presently functioning to varying degrees of success within the Old Bridge Sand outcrop in the Old Bridge-Spotswood area. The Duhernal Water System along with the P.J. Schweitzer and Anheuser Busch Companies pump for wells adjacent to Duheranl Lake which was constructed in 1938 in order to enhance recharge to the Old Bridge Sand. Although the amount of water that is recharged varies, estimates made in 1969 identified that the average rate of recharge for the 173 acre Duhernal Lake is 67,000 gallons/day/acre or approximately 12 mgd is artificially recharged. 19 In recent years, the Duhernal Company has excavated additional recharge ponds adjacent to the lake increasing the recharge area to 221 acres. Total recharge now exceeds 15 mgd.

The Perth Amboy Water Department utilizes Tennent Pond within the Runyon Watershed for artificial recharge purposes. This 63 acre pond recharges the groundwater at a rate of 80,000 to 90,000 gallons/day/acre. A study conducted by Henry C. Barksdale in 1941 indicated that approximately 5 mgd, or virtually the entire flow of Tennent Brook, was being used to recharge the Old Bridge Sand. 20 An additional 100 acre recharge pond on the Deep Run, now in the planning and design stage, is expected to increase the yield of the Perth Amboy wellfield by an additional 7 mgd. 21 The Sayreville Water Department has recently constructed an artificial recharge pond having a total surface area of 66 acres. This pond has been designed to recharge the Old Bridge Sand and is estimated to increase the yield of the Bordentown wellfield by about 4 mgd.

In brief, the safe yield and natural recharge capacity of the Old Bridge Sand has been augmented by some 21.0 mgd, as shown in Table 5 below. Groundwater withdrawal from Old Bridge Sand in the County is within the natural safe yield of 31.0 mgd and total safe yield of 52 mgd.

At the present time artificial recharge is not taking place in Middlesex County to increase the productivity of the Farrington Sand. As noted earlier, groundwater withdrawal from the Farrington Sand is in excess of 18.5 mgd while the safe yield is only 16.2 mgd.22 This strongly suggests that the safe yield of the Farrington Sand is being exceeded evidenced by the decline in the water table and resulting salt water intrusion in the Sayreville area. Due to the location of several wells near the Washington Canal and in the zone of

TABLE 5
Artificial Recharge Operations in Middlesex County - 1974

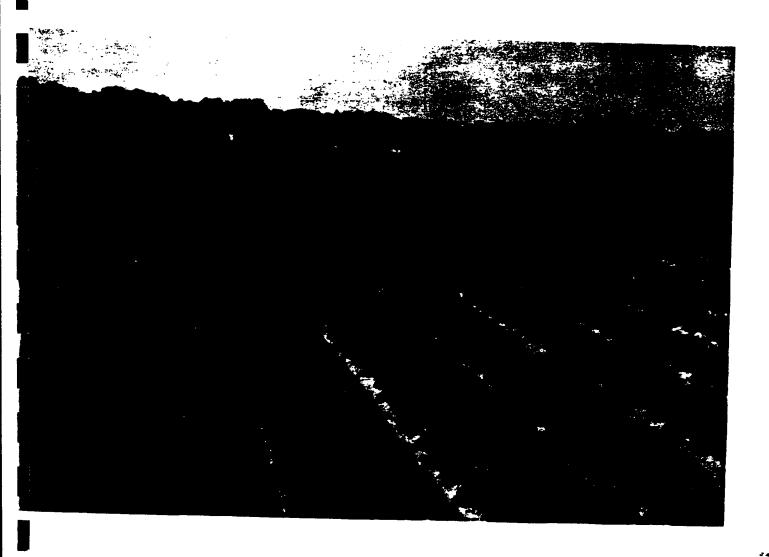
·	Area of Recharge Fond (acres)	<u>Safe Yield</u>
Duhernal Water Company	221	15.0
Perth Amboy Water Dept.	63	5.0
Perth Amboy Water Dept. (Planned)	100 (est.)	7.0 (est.)
Sayreville Water Dept.	66	4.0
Total	450	31.0

REFERENCE NO. 17

United States Department of Agriculture

Soil Conservation Service In cooperation with
New Jersey Agricultural
Experiment Station,
Cook College,
Rutgers,
the State University,
and the
New Jersey Department of
Agriculture

# Soil Survey of Middlesex County New Jersey

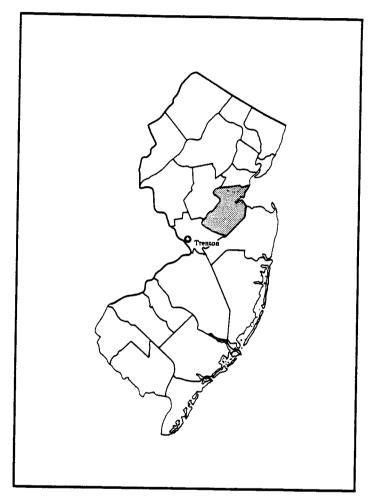


This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1978. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made by the Soil Conservation Service in cooperation with the New Jersey Agricultural Experiment Station, Cook College, Rutgers, the State University, and the New Jersey Department of Agriculture. Others who contributed to the survey were the Middlesex County Board of Chosen Freeholders and the Freehold Soil and Water Conservation District. The survey is part of the technical assistance furnished to the Freehold Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: A field of Japanese yews in Middlesex County.



Location of Middlesex County in New Jersey.

Included with this soil in mapping are small areas of soils similar to this Tinton soil but with more glauconite, a thicker or thinner surface layer, or a surface layer of sendy loam and areas of Fort Mott soils. They make up as much as 25 percent of the unit and generally are managed the same as this Tinton soil. Also included are small areas of Pemberton, Holmdel, and Shrewsbury soils that make up about 15 percent of the unit. They are in depressions or low positions. The other inclusions are throughout the unit.

The permeability of this Tinton soil is moderate or moderately rapid. Available water capacity is moderate. Runoff is slow, and the erosion hazard is moderate. Organic matter content is low, and natural fertility is medium. Tilth is good. In unlimed areas the surface layer is extremely acid and the subsoil and substratum are very strongly acid. The depth to the substratum ranges from 20 to 36 inches but is generally 24 to 30 inches.

This soil is suited to cultivated crops, pasture, or woodland. Vegetables and fruits are the common crops. The main management concerns are the hazard of erosion, low fertility, droughtiness, and the need to increase the organic matter content. Soil blowing is severe if areas are unprotected in winter. Using crop residue maintains or increases organic matter content and reduces soil blowing. The use of lime and fertilizer offsets acidity and low fertility. Conservation tillage and the use of cover crops and grasses and legumes in the cropping system help to reduce runoff and erosion.

This soil is suited to pasture, but the moderate available water capacity is a limitation. Proper seeding, proper stocking, and rotation grazing are the major management practices on this soil.

This soil is suited to trees, and potential productivity is moderately high. Black oak, white oak, and scarlet oak are common in most places, but pines are common where fields have been left idle. Protection from fire is the major management concern.

This soil is generally suitable for most urban uses. The texture of the surface layer and substratum limit the soil as a site for lawns, landscaping, and golf fairways. Some recreation uses are limited by slope.

Capability subclass: IIIs.

**UB—Udorthents, bedrock substratum.** This unit is nearly level to gently sloping. The areas are irregular in shape and range mainly from 2 to 15 acres. Most areas are smaller than 5 acres. The most extensive areas are principally in Edison, New Brunswick, and North Brunswick Townships.

This unit has been cut and smoothed or otherwise extensively disturbed to a depth of 3 feet or more. The original soil has been removed.

Included with this unit in mapping are small areas of Klinesville, Reaville, Reaville Variant, and Ellington soils on uplands and along the perimeter of the disturbed

areas. Small areas of Udorthents, wet substratum, and Urban land are also included.

Some areas of this unit are in native vegetation. Some areas are used for parking lots, landfills, or recreation areas. The variability of the characteristics of this unit makes onsite investigation necessary to determine the suitability of the unit for any use.

Capability subclass: not assigned.

**UC—Udorthents, clayey substratum.** This unit consists of deep, moderately well drained to somewhat poorly drained soils mostly in regraded clay pits or borrow areas. The surface has been smoothed, and the areas are nearly level.

Most areas of this unit are used for residential, commercial, or industrial development. The variability of the characteristics of the unit makes onsite investigation necessary to determine the suitability of the unit for any use.

Capability subclass: not assigned.

**UD—Udorthents, wet substratum-Urban land complex.** This unit consists of moderately deep, moderately well drained, loamy soil and urbanized areas. The areas are principally in housing developments or apartment complexes. They dominantly are graded spoil excavated for cellars or foundations or that has been trucked in from nearby areas.

The Udorthents in this unit have a seasonal high water table near the surface. In some areas fill material has been used to cover the water table and thus improve the suitability of the unit as a building site. The thickness of the fill material is 2 to 4 feet, and the average thickness is about 30 inches. The Udorthents are mainly in areas of Fallsington Variant, Reaville Variant, and Parsippany Variant soils.

The variability of the characteristics of this unit makes onsite investigation necessary to determine the suitability of the unit for any use.

Capability subclass: not assigned.

**UL—Urban land.** This unit consists of areas where more than 80 percent of the surface is covered by industrial plants, shopping and business centers, and other structures. These areas are nearly all in the highly populated northern half of the county. The areas generally range from 2 to 1,000 acres. Most are nearly level to moderately sloping, but a few are strongly sloping and steep. Fill material has been used in places to build up wet soils. Most areas have been excavated or filled with material that is now almost totally paved.

Onsite investigation is needed to determine the potentials and limitations of this unit for any use.

Capability subclass: not assigned.

Wa—Watchung very stony silt loam, 0 to 2 percent slopes. This soil is nearly level and poorly drained. It is

REFERENCE NO. 18

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT

DIVISION OF WATER POLICY
AND SUPPLY



SPECIAL REPORT NO. 27

GEOLOGY AND GROUND WATER RESOURCES

RAHWAY AREA, NEW JERSEY

Ohited States Department of the Interior
Geological Juryay

1958

# GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY

By

HENRY R. ANDERSON

Geologist, U. S. Geological Survey

SPECIAL REPORT NO. 27

1968

Prepared by the U. S. Geological Survey in cooperation with the State of New Jersey

#### STATE OF NEW JERSEY

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## GEOLOGY AND GROUND-WATER RESOURCES OF THE RAHWAY AREA, NEW JERSEY

#### ABSTRACT

The Rahway area occupies 67 square miles of the Piedmont Plateau and Coastal Plain physiographic provinces in northeastern New Jersey. Lowlands, from less than 10 feet to 80 feet in altitude, constitute most of the area. A terminal moraine of Wisconsin age forms uplands that range in altitude from 100 to 240 feet. The Rahway River, the principal stream, follows a preglacial drift-filled channel through the city of Rahway, and flows into the Arthur Kill.

The Brunswick Shale of Triassic age which underlies the report area is a massive, fractured shale containing sandstone beds. It is more than 6,000 feet thick. The shale strikes N. 50° E. and dips about 9° to 12° NW. The Raritan Formation of Cretaceous age overlies the Brunswick unconformably in the southeast corner of the area. The Raritan Formation is a series of clays and sands of about 100 feet in thickness in the outcrop area. It strikes about N. 45° E. and dips less than 1° SE.

Wisconsin glacial drift, ranging in thickness from several feet on hilltops to 100 feet in the terminal moraine, blankets the Brunswick Shale and Raritan Formation.

About 6 mgd (million gallons of water per day) is pumped from the Brunswick Shale, which yields water from fracture openings and from pore spaces in the interbedded sandstone. As depth increases, the fractures become smaller and fewer in number and hence yield less water. Recharge to the Brunswick occurs through the hydraulically continuous overlying drift. Interference between wells in the Brunswick is greatest where wells are aligned along the strike of the formation and least where wells are aligned perpendicular to the strike. Both water-table and artesian conditions exist in the Brunswick Shale. Artesian conditions occur generally at depths greater than 100 feet; water-table conditions occur at shallower depths. The average yield of 150 industrial, publicsupply, and domestic wells is 75 gpm (gallons per minute). The average specific capacity is 2.2 gpm per foot of drawdown and the average well depth is 218 feet. All industrial and public-supply wells in the Brunswick Shale having a specific capacity of less than one are in the southeastern half of the area.

Ground water from the Brunswick Shale is locally high in sulfate, dissolved solids, and hardness. This is owing to solution of gypsum and calcite in the formation. Concentrations of these constituents increase with depth.

Det N

wood Cata Brackish water is contained in the Brunswick Shale along the tidal reach of the Rahway River and northward along the Arthur Kill. South of the Rahway inlet, the Raritan fire-clay, locally the basal member of the Raritan Formation, overlies the Brunswick Shale and retards seawater inflow from the Arthur Kill.

About 1 mgd is pumped from the Farrington and Member of the caritan Formation in the report area. Twelve indistrial wells have an average yield of 96 gpm, an average specific capacity of 9.5 gpm per foot of drawdown, and an average depth of 60 feet. The Farrington Sand Member is hydraulically separated from the Brunswick Shale by the basal Raritan fire-clay. Salt water is encountered in wells in the outcrop area adjacent to the Arthur Kill.

A stratified-drift deposit having an average thickness of 30 feet underlies the city of Rahway. More than a million gallons per day is pumped from four wells tapping both the drift and the underlying Brunswick Shale. The average yield of the wells is 370 gpm, and the average specific capacity is 15.3 gpm per foot.

Diabase

Wissahickon Formation

Schist and gneiss

PALEOZOIC (?)

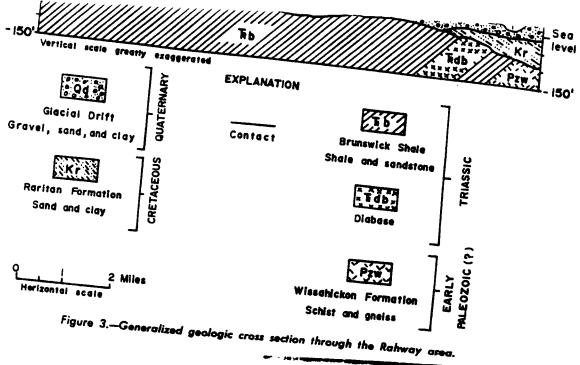
Figure 3.—Generalized geologic cross section through the Rahway area.

Sand and clay

Horizontal scale

# TABLE 1.—STRATIGRAPHIC UNITS IN THE RAHWAY AREA AND THEIR GEOLOGIC AND HYDROLOGIC CHARACTERISTICS

·h		Unit	Geologic characteristics	Hydrologic characteristics				
		Alluvium	Muds and sands deposited in river channels and estuaries; 0 to 50 feet thick.	Muds are relatively impermeable and serve to retaid seepage between rivers and the ground-water reservoir, and most important, to retaid flow of saline water through river beds.				
		Eolian deposits	Sand, white, forming dunes along the Arthur Kill. Less than 10 feet thick.	Deposits lie above water table but transmit water readily to underlying sediments because of high infiltration capacity and permeability.				
		Till	Clay, sand, and gravel, reddish-brown, unstratified, and unstrated. Forms most of the surficial ground and terminal moraine deposits; 0-100 feet thick. Deposited directly by glacier.	Not an important source of ground water because of low permeability and small thickness which lies below the water table. Yields water to dug domestic wells.				
		Stratified drift	Sand and gravel, sorted and stratified, occurring as fill in bed- rock channels and interbedded with till in the terminal moraine; 0-50 feet thick. Deposited by water.	Important as an aquifer only in the city of Rahway where wells tap both the Brunswick shale and stratified drift and induce recharge from the Rahway River. Average well yield 370 gpm. Quality of water is good.				
		Pensauken Formation  T Unconformity	Sand and gravel; chiefly quartz. Some pebbles and cobbles of shale, sandstone, quartz and crystalline rocks.	Yields no water to wells.				
		Sayreville Sand Member	Sand, fine to coarse, white, micaceous; contains clay and arkosic sand beds. Locally crossbedded. 0-40 feet thick.	Not an important source of water north of the Raritan River as much of it lies above the water table. At Sayreville, N. J. the specific yield ranges from 32 to 30 percent and the coefficient of permeability ranges from 30 to 500 gpd per sq. ft.				
	rma tion	Woodbridge clay	Upperbeds — clay, black lignitic; contains siderite, pyrite, and interbedded sand lenses. Lowerbeds – clay, varicolored and locally sandy. Total thickness 0-60 feet.	Confining bed.				
	Ratitan Formation	Farrington Sand Member	Sand, fine to very coarse, light colored; contains interbedded arkosic sand and clay. 0-80 feet thick.	Yields moderate amounts of good quality water. Average transmissibility 10,000 gpd per ft. Average well yield is 96 gpm. Salt water encountered in wells adjacent to the coast. Permeabilities at Parlin, N. J. range from 210 to 3,500 gpd per sq. ft. Specific yield ranges from 25 to 36 percent.				
		Raritan fire clay  Unconformity	Clay, varicolored blue, brown, gray, or red. Reddish-brown at basal contact with Brunswick Shale. 2-35 feet thick.	Confining bed.				
		Igneous intrusive	Buried diabase sill in southeastern part of report area that forms Palisades where it crops out on Staten Island.	Dense and relatively impermeable. No wells tap the sill.				
	Newark Group	Brunswick Shale	Shale, reddish-brown, fractured; contains interbedded sandstone. Underlies glacial drift and Raritan Formation in the Rahway area. Altered to hornfels adjacent to diabase. 6,000 to 9,000 feet thick. Strikes N. 50° E. Dips 9-12° NW.	Most intensely developed aquifer in area. Yields small to moderate quantities of water from primary openings in sandstone and from secondary openings which decrease with depth in shale and sandstone. Water locally high in sulfate, total dissolved solids, and hardness. Both water table and artesian conditions exist. Interference is greatest between wells aligned along strike of formation. Average transmissibility 16,000 gpd per ft. Yield range 2 to 660 gpm. Average				



					- 10 W mag		Kariw	ay area.				-
		MES	ozorc	77.27						a problem and the	Carry.	-
Triassic			Creu	ICEOUS			in the second	Quatern	цу		Period	
Late Triassic			Late Cre	taceous			Pleistoc	ene		Recent	Epoch	
Newark Group			Raritan Fo	rmation								1
Brunswick Shale	Igneous intrusive	Raritan fire clay Unconformity	Farrington Sand Member	Woodbridge clay	Sayreville Sand Member	Pensauken Formation  T Unconformity	Stratified drift	718	Eollan deposits	Alluvium	Unit	TABLE 1.—STRATIGRAPHIC UPITS
Shale, reddish-brown, fractured; contains interbedded Underlies glacial drift and Raritan Formation in the Rares. Altered to hornfels adjacent to diabase. 6,000 fee: thick. Strikes N. 500 E. Dips 9-120 NW.	Buried diabase sill in southeastern part of report area Palisades where it crops out on Staten Island.	Clay, varicolored blue, brown, gray, or red. Reddisl at basal contact with Brunswick Shale. 2-35 feet thic	Sand, fine to very coarse, light colored; contains interal sand and clay. 0-80 feet thick.	Upperbeds — clay, black lignitic; contains siderite, j and interbedded sand lenses. Lowerbeds - clay, varic and locally sandy. Total thickness 0-60 feet.	Sand, fine to coarse, white, micaceous; contains cla arkosic sand beds. Locally crossbedded. 0-40 feet t'	Sand and gravel; chiefly quarts. Some pebbles and oshale, sandstone, quartz and crystalline rocks.	Sand and gravel, sorted and stratified, occurring as f rock channels and interbedded with till in the termin 0-50 feet thick. Deposited by water.	Clay, sand, and gravel, reddish-brown, unstratified, acted. Forms most of the surficial ground and termi aine deposits; 0-100 feet thick. Deposited directly t	Sand, white, forming dunes along the Arthur Kill. 1 10 feet thick.	Muds and same deposited in river channels and estuar	Geologic characteristics	C UPITS IN THE EASTWAY AREA AND THEIR GEO

## 14 GROUND-WATER RESOURCES OF THE RAHLA AREA, N. J.

#### **HYDROLOGY**

Water falls to the earth's surface as precipitation. Part is intercepted by vegetation, pavements, and buildings before reming the ground and is evaporated. Part infiltrates the ground to become all moisture, capillary water, and ground water. The remainder of the water runs off the land surface to the streams. Evaporation and the piration take place during these processes, returning to the atmosphere moisture which eventually becomes precipitation again.

#### OCCURRENCE OF GROUND WATER

Water that percolates to the zone of saturation a ground water. The water table is the upper surface of the zone of saturation and separates that zone from the overlying zone of aeration. The moisture content of the zone of aeration ranges from saturation to adry state.

Ground water in the Rahway area is stored in transmitted through pore spaces of unconsolidated sediments such as clacial drift and the Raritan Formation. Joints and other fractures store and transmit the water in the consolidated rocks of Triassic age.

Water-table, or unconfined, ground-water conditions exist when the top of the zone of saturation is at atmospheric pressure. Such conditions occur in the stratified drift in Rahway, in the outcrop area of the Raritan Formation, and at shallow depths in the Brunswick Shale.

Artesian, or confined, conditions occur where ground water is under hydrostatic pressure greater than atmospheric pressure. Pumping from a confined aquifer quickly lowers the artesian pressure and water levels drop rapidly in nearby wells penetrating the same aquifer. Artesian conditions are found in the deeper parts of the Brunswick Shale and in the Raritan Formation beneath the Woodbridge clay. Several artesian wells in the Brunswick Shale flow; these are aligned northeast-southwest along the South Branch of the Rahway River. These wells probably tap a common fracture or fault system which trends northeast-southwest through the area.

#### MOVEMENT OF GROUND WATER

Ground water moves from points of high ground-water head to points of lower ground-water head. The generalized water-level contour map of the area (fig. 5) shows the altitudes of ground-water levels at the time of well completion. As water-level highs generally coincide with topographic highs, ground water flows generally in the same direction as overland surface flow. Ground-water movement is toward the Rahway River and its branches and through the gravel-filled valley extending from Rahway to the Arthur Kill. Hydraulic gradients range from less than

10 feet per mile, in the Rahway lowland, to more than 80 feet per mile in the southwest half of the area, where the greatest topographic relief occurs.

# RECHARGE, DISCHARGE, AND WATER-LEVEL FLUCTUATIONS

Recharge to the zone of saturation occurs primarily from precipitation that infiltrates the soil and percolates to the water table. The amount of precipitation that reaches the water table varies throughout the year and depends on the vegetative cover, soil moisture and permeability, temperature, and the type, duration, and intensity of precipitation.

Ground-water recharge may occur also along streams and lake banks by influent seepage from surface-water bodies after heavy rainfalls. The river or lake level rises faster from direct precipitation and surface runoff than does the water table. The slope of the water table is temporarily reversed and surface water seeps into the aquifer. This water is bank storage and is returned to the stream or lake once the surface-water level falls below the water table.

When the amount of water reaching the zone of saturation exceeds the amount being withdrawn by natural and artificial discharge, the water table rises. As shown in figure 6a, the rise in water levels indicates recharge exceeds discharge from the end of October to the middle of April, during the time when evapotranspiration is lowest.

Discharge of ground water occurs both naturally and artifically. Discharge by natural means includes effluent seepage to perennial streams. lakes, and tidal areas; transpiration by plants whose roots extend to the water table or the overlying capillary fringe; and evaporation where the water table is near the land surface. Ground water is discharged artificially by the pumping or flowing of wells. Discharge from flowing wells in the Rahway area is slight. The amount removed by pumping, however, is significant and is about 8 mgd, of which about 5 or 6 mgd are from the Rahway River watershed area.

The decline in water level in the hydrograph of observation well 26.21.5.4.6 (fig. 6a) shows that discharge exceeds recharge to the water table during the growing season, April through October. The decline in ground-water levels is accompanied by a decrease in stream runoff. April through October (fig. 6b). Stream runoff declines partly because as the water-table gradient decreases ground water discharge to the streams decreases. Overland flow to streams also decreases during the spring-summer period because most precipitation either evaporates or infiltrates the soil, where it is transpired by plants. It is apparent from figure 6c that evapotranspiration is at its peak and exceeds precipitation

# GEOLOGIC FORMATIONS AND THEIR HYDROLOGIC CHARACTERISTICS

#### TRIASSIC SYSTEM

#### Brunswick Shale

#### Geology

The Brunswick Shale is the youngest formation of the Newark Group, which consists of the Stockton Formation, Lockatong Formation, and the Brunswick Shale. The Brunswick Shale has the most extensive outcrop area and is composed of 6,000-8,000 feet of fractured reddish-brown shale and locally interbedded sandstone. Sandstone beds increase in abundance northeastward, becoming predominant in the northernmost part of the outcrop area in New Jersey. Along the northwest edge of the outcrop, the Brunswick grades into a conglomerate. According to Boch (1959), the red color originates from reworked hematite, which comprises 5 to 10 percent of the formation. Although red predominates, some purple, green, yellow, and black layers occur in the lower 2,000 feet of the Brunswick.

In the Rahway area, the characteristic reddish-brown shale constitutes most of the formation, although interbedded sandstone and green and black shale also occur. Glacial drift blankets the Brunswick in most of the area, but exposures can be seen at Iselin and Menlo Park. Shale intruded by the Palisade Diabase is altered into a spotted hard slate that is dark green to gray in color.

The Brunswick Shale strikes N. 50° E. and dips 9° to 12° NW in the report area. The predominant system of fractures strikes about N. 45° E. and is vertical. A second, less prominent, system strikes N. 75° W. and is nearly vertical.

The presence of ripple marks, mudcracks, raindrop impressions, reptile footprints, and plant, reptile, and fish fossils indicates that the Brunswick Shale was deposited in a shallow-water continental environment.

The source of the sediments is generally considered to be Precambrian or early Paleozoic(?) metamorphic and igneous rocks to the southeast. The occurrence of detrital micas and feldspars support this.

The Brunswick Shale conformably overlies and is interfingered with the Lockatong Formation. In northern New Jersey, where the Lockatong is absent, the Brunswick overlies the Stockton Formation.

On exposure to weathering, the shale disintegrates readily into blocky and nodular-shaped fragments and chips that flake off along the bedding planes (fig. 8). The shale ultimately disintegrates into a hard clay.

Docto





Figure 8.—Photograph of exposure of the Brunswick Shale on the north hore of the Raritan River at Perth Amboy, showing the secondary fractures and nodular-shaped weathering fragments.

#### HYDROLOGIC CHARACTERISTICS

More ground water is obtained from the Brunswick Shale than from iny other formation in the Rahway area. Approximately 90 percent of the wells in the report area tap the Brunswick, and they yield a total of more than 6 mgd. The remaining 10 percent of the wells obtain water from the Raritan Formation or glacial drift.

Water is stored and transmitted primarily in the secondary fracture openings that formed after the deposition of the sediments. The primary opening or pores between the particles in the shale are too small to transmit water readily. Locally, the fracture openings are widened by percolating ground water that dissolves material from the walls of the fractures. The size of the fracture openings generally decreases, with depth, because the weight of overlying rock increases.

Cavities formed by the solution of calcite and gypsum may be common locally, but are not considered an important source of ground water.

The Brunswick Shale and the overlying glacial drift are hydraulically continuous in most areas. Infiltrated precipitation percolates directly through the till or stratified drift and into the fracture openings of the shale.

Ground water occurs under both water-table and artesian conditions in the Brunswick Shale. If the fractures have nearly vertical dips and

are hydraulically continuous with permeable drift, ground water is inconfined and water-table conditions prevail. This condition is found commonly in wells less than 100 feet deep. A decline in the water level in a water-table well indicates that part of the aquifer has been dewatered.

Where the fracture openings do not extend upward to permeable drift or where permeable sandstone layers are interbedded with impermeable shale, ground water is confined under artesian pressure. The lowering of the water level in an artesian well reflects changes in pressure within the aquifer and does not indicate dewatering of the aquifer. Wells penetrating the Brunswick Shale are uncased below the glacial drift, so both water-table and confined zones may be intercepted in a single well.

The observation well at Hatfield Wire and Cable Co. (26.31.2.3.5) responds as an artesian well. The water level in this well lies below the regional water table and drops about 6.4 feet in 2 hours when an air-conditioning well (26.31.2.5.3.) 3.500 feet to the southwest begins pumping. The two wells are aligned parallel to strike and probably penetrate the same system of bedding-plane fractures or sandstone beds. Other wells nearly at right angles to a line connecting these two and only a few hundred feet distant from the pumping well show a smaller drop in water levels. This suggests that water levels in wells aligned perpendicular to the strike of the Brunswick Shale interfere less with one another than wells aligned parallel to the strike.

The Brunswick is not a homogenous isotropic aquifer as the permeability varies greatly from one area to another as well as with direction at any one locality. In most cases, the drawdown rate in an observation well is greatest when the observation well and the pumped well are aligned parallel to the strike of the formation. Data obtained by Herpers and Barksdale (1951) from pumping tests in Newark, New Jersey, demonstrated similar conditions.

Wells that tap the Brunswick Shale range in yield from 2 to 660 gpm, and the average is 75 gpm. Yields of wells larger than 6 inches in diameter (non-domestic use) average 140 gpm.

Specific capacities of all Brunswick Shale wells range from 0.1 to 25 gpm per foot of drawdown and average 2.2. For wells larger than 6 inches in diameter, the average specific capacity is 3.6 gpm per foot of drawdown. Wells 26.21.8.2.9A and 26.31.1.3.1B (table 5) in the northwestern half of the area, penetrate sandstone beds and have specific capacities greater than 7. All industrial and public-supply wells with a specific capacity of less than one occur southeast of a diagonal line extending from Metuchen to Elizabeth. Hence, specific capacities are, on the average, greater in the northwestern than in the southeastern half of the

## 26 GROUND-WATER RESOURCES OF THE RAHWAY AREA, N. J.

Depths of wells in the Brunswick Shale range from 60 to 1,566 feet and average 218 feet. For wells larger than 6 inches in diameter, the average depth is 340 feet.

Quality of water

The quality of water in the Brunswick Shale varies greatly with locality and depth. The ground water in some areas is highly mineralized, averaging more than 500 ppm of dissolved solids. Locally, it contains excessive amounts of sulfate.

Mineralization of ground water generally increases with depth. This relation is illustrated by the Merck well (26.31.2.6.7B), which is 1,108 feet deep. Water samples from the Merck well contained 1,795 ppm sulfate and 280 ppm calcium. Ground water from the Squire Island (26.31.2.6.4) 300-foot well and the Milton Lake (26.31.2.7.4) 301-foot well, contain 1,358 and 883 ppm sulfate, 279 and 198 ppm calcium, and 2,660 and 1,445 ppm dissolved solids, respectively. The Security Steel well (26.31.5.9.4), which is 614 feet deep, yields water with only 162 ppm sulfate, 67 ppm calcium, and 528 ppm dissolved solids. The unusual concentrations of sulfate and calcium may be from solution of calcite and gypsum layers within the formation.

The tidal reaches of the Rahway River and Arthur Kill also have high concentrations on these constituents but low chloride concentrations in the well samples indicate that salt-water intrusion is not the cause of the high mineralization.

The average temperature of water in the Brunswick Shale is about 55°F. Temperatures are generally lowest near the water table and increase with depth. The Standard Oil Company well (26.32.1.1.8) drilled in May 1920 to a depth of 1,556 feet encountered water which increased in temperature from 70° to 90°F below 800 feet in depth.

Salt-water contamination

Because the Brunswick Shale has at least a partial hydraulic connection with the Arthur Kill, whose water has a chloride concentration greater than 15,000 ppm, an interface is developed between the salt water of the estuary and the less dense, fresh ground water in the aquifer. According to the Ghyben-Herzberg principle (Drabbe and Ghyben, 1889 and Herzberg, 1901) the hydrostatic pressure at the base of a 41-foot column of fresh water of density 1.000 equals the hydrostatic pressure at the base of a 40-foot column of salt water with an average density of 1.025. Applying this relation to coastal aquifers such as the Brunswick Shale, salt water theoretically occurs 40 feet below sea level where the ground-water head in a well is one foot above sea level. Consequently, if ground-water levels are allowed to decline to below sea

Consequently if ground-water levels are allowed to decline below sea level, the fresh ground water will be replaced eventually by sea water. Brackish water is contained in the Brunswick Shale along the tidal reach of the Rahway River and northward along the Arthur Kill. South of the Rahway inlet, the Raritan fire-clay overlies the Brunswick and retards sea-water inflow.

#### CRETACEOUS SYSTEM

#### Raritan Formation Geology

The Raritan Formation of Late Cretaceous age covers about 9 square miles in the southeast part of the Rahway area. Most of the formation overlain by glacial drift, but is exposed at the surface where commercial clay and sand pits have been developed. The Raritan Formation was named by T. A. Conrad in 1869 who described its lower clay members exposed along the Raritan River.

The Raritan Formation consists of light-colored alternating sands, clays, and gravels of continental origin, interbedded with tongues of marine sediments. The upper and lower parts of the formation are predominantly sand, the lower sands being coarser and more arkosic than the upper. The middle of the formation contains white clays which weather to red, and also dark lignitic clays that grade laterally and vertically into white or red non-carbonaceous clays. The sands are characteristically well sorted, medium to coarse grained, and micaceous; they are locally cross-bedded. The clays are massive, plastic, and contain pyrite, lignite, and carbonized material which imparts a bluish or gray color.

The thickness of the Raritan changes locally because the materials were deposited on an irregular surface of Triassic, Precambrian, and early Paleozoic(?) rocks. In outcrop, the thickness ranges from 150 to 300 feet. Downdip to the southeast, it thickens to more than 1,000 feet.

A variety of fossil fauna and flora which have been found include brackish water and marine pelecypods, dicotyledons related to modern flora, and dinosaur footprints. The Raritan is considered to be Late Cretaceous in age.

Kümmel (Ries, Kümmel, and Knapp, 1904) divided the Raritan in Middlesex County into seven members according to lithology. The members were later renamed by Barksdale and others (1943), from oldest to youngest, (1) Raritan fire clay, (2) Farrington Sand Member, (3) Woodbridge clay, (4) Sayreville Sand Member, (5) South Amboy fire clay, (6) Old Bridge Sand Member, (7) Amboy stoneware clay. Because of their lenticular nature, the members are not traceable outside the

county. The four lower units crop out in the report area and will be discussed as Kümmel described them.

The Raritan fire clay is a white, light blue, or spotted red clay that grades downward into a reddish-brown color toward the underlying Brunswick Shale. It ranges from 2 to 35 feet in thickness and is found mostly in depressions in the Brunswick Shale where it grades almost imperceptibly into the Brunswick. The top of the clay is undulatory and is overlain by the Farrington Sand Member of the Raritan Formation or by glacial drift.

The Farrington Sand Member is mostly an angular quartz sand containing, locally, thin beds of gravel and seams of clay. The upper part is a medium- to fine-grained sand, and the lower 10 to 20 feet are light-gray to light-yellow, coarse, arkosic sand containing rounded quartz and black chert pebbles 6 to 50 mm in diameter. The maximum thickness of the sand in Middlesex County is 80 feet, but it is thinner in the

The Woodbridge clay overlies the Farrington Sand Member. The Woodbridge ranges in thickness from 50 to 80 feet but it is eroded to 20 feet in some exposed areas. It ranges from a fire clay at the base to a black laminated lignitic clay at the top. The thickness of the upper bed ranges from 30 to 60 feet where it is not eroded. The basal fire clay is light blue to gray or mottled red in color and has an average thickness of about 20 feet. The average quartz sand content of the fire clay is about 5 percent; however, the bottom and top parts contain as much as 50 percent sand. The base of the fire clay is undulatory. Its upper surface is irregular where glaciers have scoured away some of the top

The Sayreville Sand Member is an irregular channel-fill deposit composed of a feldspar sand and a kaolin sand. The sands are lenticular and do not occupy definite stratigraphic horizons. The feldspar sand ontains subrounded quartz grains, kaolinized feldspar, and clay pellets. The kaolin sand is a micaceous, very fine-grained white quartz sand containing white clay. At Sayreville, 8 miles southwest of Woodbridge, the Sayreville Sand Member is predominantly medium to coarse grained.

## Hydrologic Characteristics

The Raritan Formation, unlike the Brunswick Shale, yields water primarily from the intergranular pore spaces. The Raritan lies almost wholly outside the Rahway River watershed. Its aquifers are separated hydraulically from the underlying Triassic shale by the basal Raritan fire clay. In the outcrop areas of the sands of the Raritan Formation, ground water is unconfined. Downdip where the sands underlie clay beds, confined or artesian conditions exist.

The Sayreville Sand Member is discontinuous laterally and much of it lies above the water table; therefore, it is not an important cource of water north of the Raritan River. Laboratory analyses of samples from exposures in Sayreville showed specific yields ranging from 32 to 39 percent and coefficients of permeability ranging from 30 to 500 gpd per square foot. The two clay members, the Raritan fire clay and the Woodbridge clay, do not yield water and act as aquicludes for the Farrington Sand Member.

Barksdale and others (1943) estimate that about 1.9 mgd was pumped from the Farrington north of the Raritan River in the 1930's and early 1940's. However, salt water, drawn in by the pumping of wells along the Arthur Kill, forced many industries to obtain water from inland public-water supply companies so that at present, only about 1 mgd is pumped from the Farrington Sand for a few large industries in the Rahway area.

Most wells tapping the Raritan have water levels that are less than 10 feet above sea level. Hence, north of the Raritan River, the aquifer has little potential yield because lowering water levels to sea level will eventually result in replacement of fresh ground water by salt water.

Results of 15 pumping tests conducted at the California Oil Company (26.31.8.8.9) in October 1950 showed a range in transmissibility from 7,000 to 14,000 gpd per foot and an average of 10,000 gpd per foot. The coefficient of storage ranged from 0.003 to 0.00001, indicating artesian conditions.

The coefficient of transmissibility of the Farrington at Parlin, which is south of the report area, is several times greater than that at the California Co. site because the aquifer is thicker there. Transmissibilities computed from pumping tests in the Parlin area are as high as 100,000 gpd per foot; the average is 50,000 gpd per foot—five times the value of the California Company tests. At Parlin, the aquifer is 80 feer thick, which is about twice as thick as it is at the California Co. site. Laboratory determinations of the coefficient of permeability of the Farrington Sand Member at Parlin range from 210 to 3,500 gpd per square foot and average 1,650 gpd per square foot. Specific yields range from 25 to 36 percent and average 31 percent.

Yields of 12 industrial wells range from 6 to 300 gpm and average 96 gpm. Specific capacities range from 1.9 to 39 and average 9.5 gpm per foot of drawdown. Wells tapping the Raritan Formation in the report area range in depth from 40 to about 120 feet, the greater depths occurring downdip. The average depth is about 60 feet.

The quality of the water from the Raritan Formation is very good for most uses. It rarely contains excessive amounts of sulfate or dissolved solids, and it is not as hard as water from the Brunswick Shale. Total dissolved solids range from 154 to 384 ppm. The temperature of the water averages about 54°F.

## Salt-water contamination

Salt-water encroachment has occurred in areas where there are heavily pumped wells adjacent to the Arthur Kill. However, 1 mile or more inland there is generally sufficient fresh-water head to allow, indefinitely, present rates of withdrawal with safety. If encroachment were to occur inland, salt water probably would flow laterally into the Farrington outcrop from Woodbridge Creek and the Arthur Kill near Sewaren. Encroachment in an updip direction from the Raritan River is possible also, as discussed by Barksdale and others (1943).

## **QUATERNARY SYSTEM**

### Pleistocene Series

## Pensauken Formation

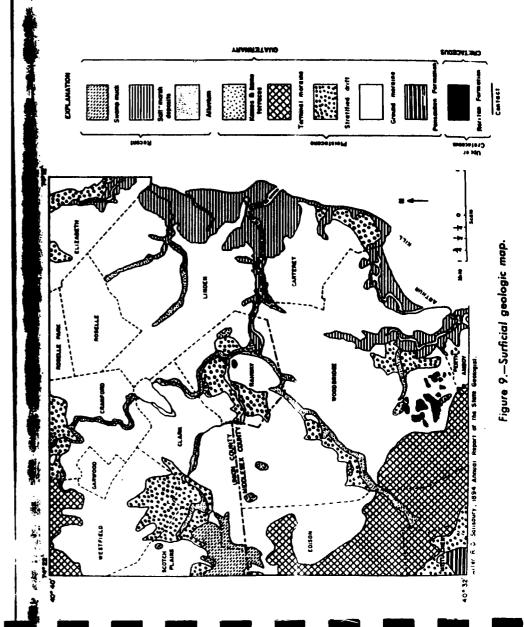
The oldest deposit of Pleistocene age in the Rahway area is the Pensauken Formation, which forms the high terrace in the southwestern corner of the area. The Formation consists chiefly of quartz sand and gravel. In addition, pebbles and cobbles of shale, sandstone, quartzite, and crystalline rocks are present. So far as known, no wells obtain water from the Pensauken Formation.

#### Glacial Drift

## Geology

Glacial drift mantles the Brunswick Shale and the Raritan Formation (fig. 9) and forms the land surface of the report area. The drift has an average thickness of about 25 feet, but ranges in thickness from a few feet on bedrock hilltops to 100 or more feet in the terminal moraine. Till, which is poorly sorted unstratified drift, occurs as ground or terminal moraine. It was deposited directly by the ice sheet. Till in the report area is characteristically a reddish-brown clay, derived from the Brunswick Shale, and contains pebbles and boulders of resistant gneiss, quartzite, sandstone, quartz, and diabase derived from rocks north of the terminal moraine. Pebbles of the Brunswick Shale are rare because the material disintegrates readily into small particles.

Stratified drift, which was deposited by glacial melt waters, occurs in thermina



The most important water-bearing drift deposit is that underlying the city of Rahway. It is predominantly a sand, containing interbedded gravels and till, that fills a preglacial stream valley. The stratified drift has a maximum thickness of 50 feet near the confluence of the Rahway River and Robinson Branch; the average thickness is about 30 feet. The lithology and general character of this deposit are variable (fig. 10).

In well drained areas, the glacial drift is leached and oxidized to a depth of 2 to 3 feet. The upper 6 to 10 inches is a dark-red-brown soil.

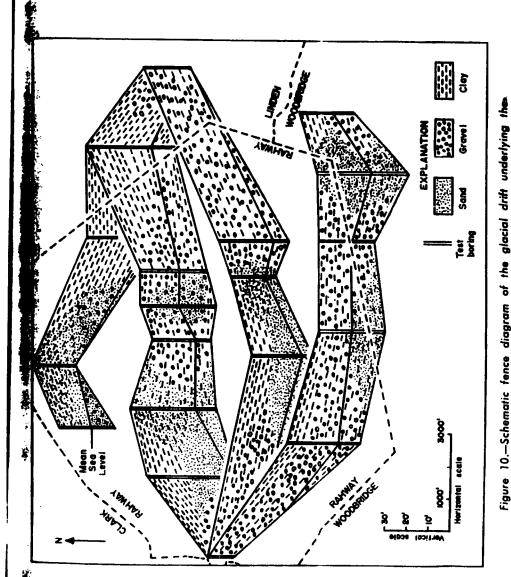
## Hydrologic characteristics

The stratified drift filling the buried valley in Rahway is the only important aquifer of Pleistocene age in the report area. The Rahway Water Department withdraws more than a million gallons of water a day from four wells that are screened 15 feet in the stratified drift and penetrate 25 to 50 feet into the underlying Brunswick Shale. The water is obtained from both stratified drift and the Brunswick Shale. The wells are near the Rahway River, and much of their yield is water induced into the aquifers from the river. The average yield of the four 10-inch diamter wells is 370 gpm. The average specific capacity is 15.3 gpm per foot. A 6-inch observation well in the well field which taps only the drift has a yield of 125 gpm, and a specific capacity of 6.2 gpm per foot.

Aquifer-test data are lacking for the stratified drift at Rahway, but some indication of its water-bearing capacity may be inferred from grain-size distribution of eight samples taken from two test wells drilled in Rahway. Laboratory coefficients of permeability for water-yielding materials having size distributions similar to the drift at Rahway are in the order of 1,000 gpd per sq ft or greater (Wenzel, 1942, p. 13). Accordingly, if the drift at Rahway has a saturated thickness of 30 feet, its coefficient of transmissibility is probably about 30,000 gpd per ft or greater. The coefficient of storage is probably between 0.1 to 0.2.

Till is not an important source of ground water in the report area because it has a low permeability, and much of it lies above the zone of saturation. In river valleys, 30 to 40 feet of till may lie below the water table. However, on bedrock hilltops capped with till the water table may be in the underlying Brunswick Shale.

An important function of glacial drift is to absorb, store, and transmit water to the underlying fractured shale wherever they are hydraulically connected. The transmissibility of the stratified drift in Rahway is ap-



ure 10.—Schematic fence diagram of the glacial drift underlying them city of Rahway.





# **ENDANGERED AND THREATENED**

## WILDLIFE AND PLANTS

**JANUARY 1, 1986** 

50 CFR 17.11 and 17.12

Department of the Interior U.S. Fish and Wildlife Service

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NUS CORPORATION REGION II

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## FISH AND WILDLIFE SERVICE LIST OF ENDANGERED AND THREATENED WILDLIFE AND PLANTS

(50 CFR 17.11, 17.12; As shown in Code of Federal Regulations, Volume 50, Revised as of October 1, 1983; 48 FR 46057, October 11, 1983; 48 FR 46331, 46336, 46337, 46341, October 12, 1983; 48 FR 49248, October 25, 1983; 48 FR 52742, 52746, November 22, 1983; 49 FR 1058, January 9, 1984; 49 FR 1994, January 17, 1984; 49 FR 2783, 2786, January 23, 1984; 49 FR 6102, February 17, 1984; 49 FR 7334, February 28, 1984; 49 FR 7394, 7397, February 29, 1984; 49 FR 10525, March 20, 1984; 49 FR 14356, April 11, 1984; 49 FR 21058, May 18, 1984; 49 FR 22329, 22334, May 29, 1984; 49 FR 27514, July 5, 1984; 49 FR 28565, July 13, 1984; 49 FR 29234, 29237, July 19, 1984; 49 FR 30201, July 27, 1984; 49 FR 31420, August 7, 1984; 49 FR 33885, 33892, August 27, 1984; 49 FR 34494, 34500, 34504, 34510, August 31, 1984; 49 FR 35954, September 13, 1984; 49 FR 40038, October 12, 1984; 49 FR 43069, October 26, 1984; 49 FR 43968, November 1, 1984; 49 FR 44756, November 9, 1984; 49 FR 45163, November 15, 1984; 49 FR 47400, December 4, 1984; 50 FR 1056, January 9, 1985)

#### Title 50-Wildlife and Fisheries

CHAPTER I—UNITED STATES FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR

SUBCHAPTER B-TAKING, POSSESSION, TRANS-PORTATION, SALE PURCHASE, BARTER, EX-PORTATION, AND IMPORTATION OF WILD-LIFE

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS Authority: Pub. L. 93-205, 87 Stat. 884; Pub. L. 94-359, 90 Stat. 911; Pub. L. 95-632, 92 Stat. 3751; Pub. L. 96-159, 93 Stat. 1225; Pub. L. 97-304, 96 Stat. 1411 (16 U.S.C. 1531 et seq.)

[Amended by 49 FR 21058, May 18, 1984; 49 FR 22329, 22334, May 29, 1984; 49 FR 27514, July 5, 1984; 49 FR 28565, July 13, 1984; 49 FR 29234, 29237, July 19, 1984; 49 FR 30201, July 27, 1984; 49 FR 31420, August 7, 1984; 49 FR 33885, 33892, August 27, 1984; 49 FR 34494, 34500, 34504, 34510, August 31, 1984; 49 FR 35954, September 13, 1984; 49 FR 43968, November 1, 1984; 49 FR 44756, November 9, 1984; 49 FR 45163, November 15, 1984; 49 FR 47400, December 4, 1984; 50 FR 1056, January 9, 1985]

### Subpert B - Lists

## §17.11 Endangered and threatened wildlife.

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(a) The list in this section contains the

been determined by the Services to be Endangered or Threatened. It also contains the names of species of wildlife treated as Endangered or Threatened because they are sufficiently similar in appearance to Endangered or Threatened species (see §17.50 et seq.).

(b) The columns entitled "Common Name," "Scientific Name," and "Vertebrate Population Where Endangered or Threatened" define the species of wildlife

within the meaning of the Act. Thus, differently classified geographic populations of the same vertebrate subspecies or species shall be identified by their differing geographic boundaries, even though the other two columns are identical. The term "Entire" means that all populations throughout the present range of a vertebrate species are listed. Although common names are included, they cannot be relied upon for identification of any specimen, since they may vary greatly in local usage. The Services shall use the most recently accepted scientific name. In cases in which confusion might arise, a synonym(s) will be provided in parentheses. The Services shall rely to the extent practicable on the International Code of Zoological Nomenclature.

- (c) In the "Status" column the following symbols are used: "E" for Endangered, "T" for Threatened, and "E [or T] (S/A)" for similarity of appearance species.
- (d) The other data in the list are non-regulatory in nature and are provided for the information of the reader. In the annual revision and compilation of this Title, the following information may be amended without public notice: the spelling of species' names, historical range, footnotes, references to certain other applicable portions of this Title, synonyms, and more current names. In any of these revised entries, neither the species, as defined in paragraph (b) of this section, nor its status may be changed without following the procedures of Part 424 of this Title.
- (e) The "Historic Range" indicates the known general distribution of the species or subspecies as reported in the current scientific literature. The present distribu-

tion may be greatly reduced from this historic range. This column does not imply any limitation on the application of the prohibitions in the Act or implementing rules. Such prohibitions apply to all individuals of the species, wherever found.

- (f)(1) A footnote to the Federal Register publication(s) listing or reclassifying a species is indicated under the colum, "When Listed." Footnote numbers to §§17.11 and 17.12 are in the same numerical sequence, since plants and animals may be listed in the same Federal Register document. That document, at least since 1973, includes a statement indicating the basis for the listing, as well as the effective date(s) of said listing.
- (2) The "Special Rules" and "Critical Habitat" columns provide a cross reference to other sections in Parts 17, 222, 226, or 227. The "Special Rules" column will also be used to cite the special rules that describe experimental populations and determine if they are essential or nonessential. Separate listing will be made for experimental populations, and the status column will include the following symbols: "XE" for an essential experimental population

population. The term "NA" (not applicable) appearing in either of these two columns indicates that there are no special rules and/or Crirical Habitat for that particular species. However, all other appropriate rules in Parts 17, 217-227, and 402 still apply to that species. In addition, there may be other rules in this Title that relate to such wildlife, e.g., port-of-entry requirements. It is not intended that the references in the "Special Rules" column

2

## Title 50-Wildlife and Figheries

## PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

## Subport B-Lists

Source: 48 FR 34182. July 27, 1983, unless otherwise noted.

## § 17.11 Endangered and threatened wildlife.

(a) The list in this section contains the names of all species of wildlife which have been determined by the Services to be Endangered or Threatened. It also contains the names of species of wildlife treated as Endangered or Threatened because they are sufficiently similar in appearance to Endangered or Threatened species (see § 17.50 et seq.).

(b) The columns entitled "Commo" Name." "Scientific Name." and "Vertebrate Population Where Endangered or Threatened" define the species of wildlife within the meaning of the Act. Thus, differently classified geographic populations of the same vertebrate subspecies or species shall be identified by their differing geographic boundaries, even though the other two columns are identical. The term "Entire" means that all populations throughout the present range of a vertebrate species are listed. Although common names are included, they cannot be relied upon for identification of any specimen, since they may vary greatly in local usage. The Services shall use the most recently accepted scientific name. In cases in which confusion might arise, a synonym(s) will be provided in parentheses. The Services shall rely to the extent practicable on the International Code of Zoological Nomenciature.

(c) In the "Status" column the following symbols are used: "E" for Endangered. "T" for Threatened. and "E [or T] (S/A)" for similarity of appearance species.

(d) The other data in the list are nonregulatory in nature and are provided for the information of the reader. In the annual revision and compilation of this Title, the following information may be amended without public notice: the spelling of species' names, historical range, footnotes, references to certain other applicable portions of this Title, synonyms, and more current names. In any of these revised entries, neither the species, as defined in paragraph (b) of this section. nor its status may be changed without following the procedures of Part 424 of this Title.

(e) The "Historic Range" indicates the known general distribution of the species or subspecies as reported in the current scientific literature. The present distribution may be greatly reduced from this historic range. This column does not imply any limitation on the application of the prohibitions in the Act or implementing rules. Such prohibitions apply to all individuals of the species, wherever found.

(f)(1) A footnote to the Federal
Register publication(s) listing or
reclassifying a species is indicated
under the column "When Listed."
Footnote numbers to §§ 17.11 and 17.12
are in the same numerical sequence,
since plants and animals may be listed
in the same Federal Register document.
That document, at least since 1973,
includes a statement indicating the basis
for the listing, as well as the effective
date(s) of said listing.

(2) The "Special Rules" and "Critical Habitat" columns provide a cross reference to other sections in Parts 17, 222, 226, or 227. The "Special Rules" column will also be used to cite the special rules that describe experimental populations and determine if they are essential or nonessential. Separate listing will be made for experimental populations, and the status column will include the following symbols: "XE" for an essential experimental population and "XN" for a nonessential

experimental population. The term "NA" (not applicable) appearing in either of these two columns indicates that there are no special rules and/or critical habitat for that particular species. However, all other appropriate rules in Parts 17, 217-227, and 402 still apply to that species. In addition, there may be other rules in this Title that relate to such wildlife, e.g., port-of-entry requirements. It is not intended that the references in the "Special Rules" column list all the regulations of the two Services which might apply to the species or to the regulations of other Federal agencies or State or local governments.

(g) The listing of a particular taxon includes all lower taxonomic units. For example, the genus Hylobates (gibbons) is listed as Endangered throughout its entire range (China, India, and SE Asia): consequently, all species, subspecies, and populations of that genus are considered listed as Endangered for the purposes of the Act. in 1978 (43 FR 6230-6233) the species Haliacetus leucocephalus (baid eagle) was listed as Threatened in "USA (WA, OR, MN, WI. MI)" rather than its entire population: thus, all individuals of the bald eagle found in those five States are considered listed as Threatened for the purposes of the Act

(h) The "List of Endangered and Threatened Wildlife" is provided below:

special reprint of 50 CFR 17.11 and 17.12 and is current as of the date shown on the cover. Minor changes and corrections to the October 1. 1965, compilation of 50 CFR have been incorporated in this printing, as well as all published final rules that have subsequent appeared in the Federal Register. Otherwise, no entry in these lists has been significantly affected. This list has been prepared by the staff of the Office of Endangered Species. U.S. Fish and Wildlife Service, Washington. D.C. 20240. Readers are requested to advise the Service of any errors in this list. Copies are available from the Publication Unit. U.S. Fish and Wildlife Service, Washington, D.C. 20240.

			Vertebrate	_			i
Common name	Scientific name	Historic range	population where endangered or threatened	Sta- tus	When isled	Critical habitat	Special rules
Caribou, woodland	Rangiler tarandus caribou	Canada, U.S.A. (AK, ID, ME, MI, MN, MT, NH, VT, WA, WI).	Canada (that part of S.E. Brit. Col. bounded by the Can USA border, Columbia R., Kootenay R., Kootenay L., and Kootenau R.), U.S.A. (ID,	E	128E, 136E, 143	NA	N
Sat Andres	i		WA).	]	j		ļ
Cal, Andean	Felis jacobita	Chile, Peru, Bolivia, Argentina	Entire	ΕÌ	15	814	١.,
Cat, black-looted	Felis nignoes	Southern Aince	do	ĒΪ	15	NA NA	N
at Rat-headed	Falis planicaps	Malaysia, Indonesia	l do l	Ě	15	NA NA	N.
at Ironate	Felie (Mayaiturus) iriomotensis	Japan (Iriomote Island, Plyukyu Islands)	ldo	Ē	50	NA NA	N N
Cat, leopard	Felis bengalensis bengalensis	India, Southeast Asia	l do l	Ē	15	NA	N
al, marbled	. Felis mermorale	Nepal, Southeast Asia, Indonesia	ااطما	Ē	15	NA NA	N
et, Pakistan sand	. Felis margarita schelleli	Pakislan	do	Ē	139	NA.	N
Cal, Temminck's (= golden cal)	Felia temmincki	Nepal, China, Southeast Asia, Indonesia (Sumatra).	<b>do</b>	Ē	15	NA	N
hamois, Apennine	Felis ligninus	Costa Rica to northern Argentina	do	Ε	5	NA	N
hestah	. Aupicapra rupicapra ornata		do	E	15	NA	N
himpanzee	Acinonyx jubatus	Africa to India	do	Εİ	3.5	NA	N
himpenzee, pygmy	Pan troglodytes	West and Central Aince	do	T	16	NA	17.400
hinchile	Pan paniscus	Zaire	do	T	16	NA.	17.400
ivet, Malabar large-spotted	Chinchille brevicaudete boliviane	Bolivia	do	Εİ	15	NA	N
ochito (=Gulf of California harbor por-	Vivera megaspila civettina	India	do	Εİ	50	NA	N
poise). Globus, Preuss's red	Phocoena sinus	Mexico (Gulf of California)		E	169	NA	N
Course coolers 8 red	Colobus badius preussi		do	Εİ	139	NA	N
ouger, easiern	Felis concolor couguar	Eastern North America	do	E	6	NA	Ñ
eer, Bactrian	Cervus elaphus bactrianus	U.S.S.R., Alghanistan	do	E	50	NA	N
eer, Baween	Axis (= Cervus) porcinus kuhli	Indonesia	do	E	3	NA:	N
eer, Barbary	Cervus elaphus berberus	Morocco, Tunisia, Algeria	do	Εĺ	50	NA	N
eer, Cedros Island mule	Odocoileus hemionus cedrosensis	Mexico (Cedros Island)	do	E	10	NA	N
leer, Columbian white-tailed	Odocoileus virginianus teucurus		do	E	1	NA	N
eer, Eld's brow-antiered	Cervus elaphus corsicenus	Corsica, Sardinia	do	E	50	NA	N
eer, Formosan sika	Cerne eti	India to Southeast Asia	do	E	3	NA	N
eer, hon	Cenus nippon taiouanus		do	E	50	NA	N
eer, key	Avis (= Červus) porcinus annamiticus		do	E	15	NA	N
eer, mersh	Odocoileus virginianus clavium	U.S.A. (FL)	do	E	1	NA	N
eer, McNeill's	Corvus elaphus macnoili	Brazil.		E	3	NA	N
per, muck	Moschus spp. (all species)	Chine (Sinkiang, Tibel)	do	E	3	NA	NA
	unnerse able (en abarres)	Central and East Asia	Alghanistan, Bhutan, Burma, China (Tibet, Yunnan), Indua, Nepal, Pakistan, Sittim.	E	15	NA .	NA
eer, North China sala	Cervus nippon mandarinus	China (Shantung and Chihli Provinces)	Entire	E	50	أميم	***
	Ozotoceros bezoerticus	Brazil, Argentina, Uruguay, Bolma, Para-	do	Ē	15	NA	NA NA

		Historic range	Vertebrate population where	Sta-	When	Critical	Specie
Common name	Scientific name	restoric range	endangered or threatened	tus	lieled	habitat	rules
aguarundi		. U.S.A. (TX), Mexico	. Entire	Ε	15	NA	N
guarundi		. Mexico, Nicerague	do	Ē	15	NA.	i N
guerundi	Felis yagouaroundi panamensis	Niceregue, Costa Rice, Panema	do	Ē	15	NA NA	"
guerundi	Felis yagouaroundi toltaca	U.S.A. (AZ), Mexico	do	Ē	15	NA NA	
angaroo, easiern gray		Australia	<b>do</b>	Ī	7	NA NA	17.40
angaroo, red		do	do	T	7	NA.	17.40(
angaroo, Tasmanian forester		. Australia (Tasmania)	do	E	6	NA	
angaroo, wastern gray		. Australia	do	Ŧ	7	NA NA	17.40
ouprey	Bos sauvoli	. Vietnam, Laos, Cambodia, Thailand	do	Ė	ا غ	NA.	
maur, capped		India, Burma, Bangladesh	do.	Ē	15	NA NA	
ingur, entellus		China (Tibet), India, Pakistan, Kashmir,	do	E	15	NA NA	
	1	Sri Lanka, Sikkim, Bangladesh.		_		1401	"
ingur, Douc		Cambodia, Laos, Vietnam	do	E	3	NA	
ingur, Francois'		Chine (Kwangsi), Indochine		E	16	NA	
ingur, golden	,	India (Assam), Bhutan	do	E	15	NA	I 1
ingur, long-tailed		Indonesia	do	T	16	NA	17.400
ingur, Pagi Island	Masals (Simies) concolor		<b>do</b>	Ė	3	NA.	
ingur, ourple-faced		Sri Lanka (=Ceyton)	do	Ŧ	16	NA	17.400
ngur. Tonkin anub-nosed		Vietnam		Ť	1 16	NA	17.40
chwe, red	Kabus lache	Southern Africa		Ť			
<b></b>		GUULUII ARCE		•	3, 15, 106	NA	IN.
<b>nurs</b>	Lemuridae (incl. Cheirogaleidae, Lepile- muridae); all members of genera Lemur, Phaner, Hapalemur, Lepile- mur, Microcebus, Allocebus, Cheiro- galeus, Varecia.	Malagasy Republic (=Madagascar)		E	3, 15	NA	٨
operd	Panthera pardus	Africa, Asia	Wherever found,	E	3, 5, 114	NA	N
		·	except where it is listed as Threatened as set forth below.				
Do	<b>do</b>	<b>do</b>	in Africa, in the wild, south of, and including, the following countries: Gebon, Congo, Zeire, Uganda, Kenya.	1	3, 5, 114	NA .	17.40(
operd, clouded		Southeast and south-central Asia, Taiwan.	Entire	E	3, 15	NA	N
operd, enow		Central Asia	do	Ē	5	NA	N
nsang, apolled	Prionadon pardicolor	Nepal, Assam, Vietnam, Cambodia, Laos, Burma.		E _	15	NA	N
on, Asiatic	Panthera leo persica	Turkey to india	<b>do</b>	Ē	3	NA	N
ris, lesser slow			do	Ţ	16	NA	17.40(0
nx, Spenish	Felis (= Lynx) partina	Spain, Portugal	<b>60</b>	E	3	NA	N
ceque, Formosan rock	Macaca cyclopis	Talwan	<b>do</b>	T	16	NA	17.40(0
aceque, Jepanese	Macaca Alecata	Jepen (Shikoku, Kyushu and Honshu is- lands).	40	7	16	NA	17.40(0
caque, kon-tailed	Macaca silenus	india	<b>do</b>	E	3	NA	N
acaque, stump-tailed	Macaca arctordes	India (Assam) to southern China	do	TI	18	NA I	17.40(c

	Species		Vertebrate population where	, I			_
Common name	Scientific name	Historic range	endangered or threatened	Sia- tus	When isted	Critical habitat	Specia rules
Muntjac, Fea's		Northern Thailand, Burma				<del></del>	
Native-cal, easiern	Desvurus viverinus	Austraka	·· <b>00</b>	E	50	NA.	l N
Numbal	Marmacohius Inscialus	do	do	E	6	NA.	l N
Ocelol	Falis perdelis	U.S.A. (AZ, TX) to C. and S. America		E	4, 6	NA.	N
Orangulan	Pongo pyameaus	Bornen Sumetre	1 4		5, 119	NA.	N
Dryx, Arabian	One leurone	Arabian Peninsula	·  ······ <b>do</b>	E	3	NA.	l N
Otter, Cameroon clawless	Agrica (Paragner) congre microdos	Comerces Nicoria	do	Εļ	3	NA.	l n
Otler, gient	Plemoura brasiliancia	Cardo America	do	Ε	3	i NA	N
Otter, long-tailed	Lute Innoincure lines platancies	South America	do	E	3	NA.	l N
Jack, manne	l Lutra fatina	do	·do	E	3, 15	NA.	l N
Otter, southern river	Lutre nonvocav	Peru south to Straits of Magellan	do	E	15	NA.	N
Otter, southern sea	Enhydra lutris nereis		do	E	15	NA	N
anda, giant		to Marico (Raja California)		T	21	NA	N
angolin (= scaly anteater)	Manis temmincki	People's Republic of China	do	E	139	NA	N
anther, Florida	Folio concello per d	Africa	do	E	15	NA NA	N
lanigale, little	Felis concolor coryi	. U.S.A. (LA and AR east to SC and FL)	ااما	Ē	1	NA NA	Ň
•	P. aubtilisaime).		[	E	4	NA	N
lanigale, southern		do	do I	Ε			
orcupine, thin-spined		.i Brazii	ا مما	Ē	3	NA	N
ossum, mountain pygmy		Australia	do	Ē	3	NA	N
Ossum, scaly-tailed	Wyulde squemicaudete	do	do	Ē	• •	NA	N.
rairie dog, Mexican	Cynomys mexicanus	Mexico	<b>G</b>	- 1	- 1	NA	N
rairie dog, Utah	Conomys pervidens	U.S.A. (UT)	00	E	3	NA	17.40(g
ronghorn, peninsuler	Antilocanta americana neninsularis	Mexico (Baja California)	<b>LD</b>	Ţ	6, 149	NA	N
ronghorn, Sonoran	Antilocapra americana annoriensis	U.S.A. (AZ), Mexico	00	E	10	NA	N
udu	Auch purh	Southern South America	00	E	1, 3	NA	N
uma, Costa Rican	Falia concolor costaricanses	Nicaragua, Panama, Costa Rica	<b>U</b>	E	15	NA	N
wokke	Setonic brachways	Australia	00	E	15	NA	N
abbit, Ryukyu	Pentalegus hungssi	Japan (Ryukyu Islands)	00	E	6	NA	N
abbit, voicano	Romanolagus diezi	Mexico	00	E	50	NA	N
at, false water	Xeromys myoides	Australia	00	E	3	NA	N
et, Freeno kangaroo	Dipodomys nitratoides exilis	U.S.A. (CA)		Εį	4	NA	NA
ni, Morro Bay kangaroo	Dipodomys heermanni morroensis	U.S.A. (UA)		E	170	17 95(a)	N/
nt, stick-nest	Leporitus conditor		<b>do</b>	E	2	17.95(a)	N
el-kangaroo, brush-tailed	Bettongia pericillata	Australia	<b>40</b>	E	6	NA	NA
al-kangeroo, Geimerd's		<b>do</b>	<b></b>	E	4	NA	NA
M-kangaroo, Lesuer's				E	6	NA	NA
N-kangaroo, plain			do	Ε	4	NA	NA
M-kangeroo, Queensland	Bettongia tropica	do	do	E	4	NA	NA
inoceros, black	Diceros bicomis	do	do	E	4	NA I	NA
inoceros, great Indian		Sub-Saharan Africa	do	E	97	NA .	NA
inoperos. Jevan		India, Napel		E	4	NA	NA
		Sikkim, Bengledesh, Melaysia.	do	E	3	NA	NA
ninoceros, northern white		Republic.	do	E	3	NA	NA
inoceros, Sumatran	trensis.		do	E	3	NA	NA
iga, Mongolian (antelope)			do	Ε	15		***
ki, white-nosed	Chiropotes albinasue		do	-	13	NA	NA
el, Ceribbeen monk			do	E .	3 45	NA	NA
al, Guadalupe fur				- F   '	. 2, 45	NA	NA COO
•		Mexico (Islas Revillacioedo).	•••••	• •	212	NA	227.11

		- [	Verlebrate			1	j
Common name	Scientific name	Historic range	population where endangered or threatened	Sta- tus	When <b>ksted</b>	Critical habitat	Specia rules
Whale, bowhead	Balaena myslicetus	Oceanic (north latitudes only)				<del> </del>	
Whale, finback	Balaenopiera physakis	Oceanie		E	3	l NA	l N
Whale, gray	Eschnchtius robustus	Oceanic	do	Ε	3		l ñ
	1	See.	do	E	<b>.</b> 3	NA.	Ñ
Whale, humpback	Megaptera novaeangkae	Connects	1	_			, "
Whale, right	Beleene plecialis	4-	do	Εİ	3	NA NA	N
Whale, Sei	Releanantere horostin	do	do	Ē	3	NA NA	
Mhale, sperm	Physician colorion	90	.ldo	ĒΙ	3	NA NA	N
Noll, gray	Cenis lupus		_A_	=	3	NA NA	l N
		Holerctic	U.S.A. 148	Ē	1, 6, 13,	,	N
		ł	Conterminous	• [	15, 35	17.95(a)	N
	Ì		States, except		15, 35	1 .	
Do			AMIN Admins	- 1		j i	
Voll, maned	do		U.S.A. (MN)			1	
	. Chrysocyon brachyurus	Argentine, Bolivia, Brazil, Paraguay, Uru-	Entire	Ţ	35	17.95(a)	17.40(0
Voll, red		CLARY.	G	E	4	NA	N
TCII, 100	Cenis nutus	. U.S.A. (southeastern U.S.A. west to	do	_ [		1 1	
M		Control TV)		E	1	NA	N.
Vombat, hairy-nosed (=Barnard's and		Australia				]	
Queensland hairy-nosed).	and L. cillescies	***************************************	·····. <b>GO</b>	E	4, 6	l NA	N
loodrat, Key Largo	Nectorne floridane smalli	LUGA (EL)		1		]	
		U.S.A. (FL)	do	E	131E.	l nai	N
ak, wild	Bos grunniens	China (Fib. at 1. 4)	i		160		•
ebra, Grew's	i Farum areasi	China (Tibet), India	do	Ε	3	NA	N/
ebra, Hartmann's mountain	Equis zebra hartmannae	Nerva, cuicola, Somalia	do	T	54	NA	NA NA
ebra, mountain	Equie zebre zebre	Namoia, Angola	اسمه	Ť	54, 111	NA	
	cyca aue aue	South Africa	do	Ė	15, 111	NA NA	NA
Birds				- 1			NA
kepa, Hawaii (honeycreeper)	Lavana aggingua anakina	1					
kepa, Maui (honeycreeper)	Loxops coccineus coccineus	U.S.A. (HI)	do	ΕÌ	2	NA	
ualoa, Kauai (honeycreeper)	LOROUS COCCINOUS OCHRACOUS		do l	Ē	5		NA
viepoleau (honeycreeper)		المام		Ē		NA	NA
batrosa, short-tailed	riemignetitus munroi ( = wilsori)	do	do I	Ē	: ! !	NA	NA
versue, situri-tensu	Diomedea albairus	North Pacific Ocean: Japan, U.S.S.R.,	Entire except			NA	NA
and bind company to the same		U.S.A. (AK. CA. HI. OR. WA)	HEA		3	NA	NA
nckbird, yellow-shouldered	Agelaius xanthomus	U.S.A. (PR)	Entire	-			
bwhite, mesked (quail)	Colinus virginianus ridowavi	U.S.A. (AZ), Mexico (Sonora)	40	E	17	17.95(b)	NA
uby, Abbout s	Sula abbotti	SVERN ( NAME: / Tarletones leleard	<b>.</b>	ΕÌ	1, 3	NA	NA
pasted	Dasyornis brachypterus longingship	Australia		E	15	NA	NA
		do	······400	E	3	NA	NA
DRODE, GUARI[		Western Positio Connect LC A 40	00	E	15 [	NA	NA
Rui, Mauritius olivaceous	Hypeipeles borbonicus olivaceus	Western Pacific Ocean: U.S.A. (Guarn)	40	E	156	NA	NA
Minch, Seo Miguel (finch)	Partule purious	Indian Ocean: Mauritius	<b>do</b>	E	3	NA I	NA
shuren, New Zeeland	Xenicus longipes	Eastern Atlantic Ocean: Azores	do	E	3	NA	NA
	Choriotis nigriceps	New Zeeland	do	E	3	NA	NA
	Plerodroma cahow	India, Pakistan	do	E	3	NA	NA
		NOTE: Allertic Ocean: Bermuda	do.	E	3	NA	NA NA
	тим уурна	Colombia to Chile and Argentine	<b>do</b>	Ē	4	NA I	NA NA
	Gymnogype californianus	U.S.A. (OR, CA), Mexico (Baia Califor-	do	Ē	il	17.95(b)	NA NA
ol, Hawaiian (=alae keo keo)	_	nie).		-	'	33(0)	MA
	Fulica americana alai	U.S.A. (HI)	do	εl	2	1	
	Compa maculate	Brazil	. do l	Ē	15	NA	NA
wys, wine-winged	Xipholene atropurpures	do	do	اءَ		NA	NA
Ine, Discr-necked	Grue nigricatie	Chine (Tibel)	do	Ē	15	NA	NA
rio, cube sangrai	Grue canadensis nesioles	West Indies: Cube	<u></u>	Ē	15	NA	NA
ine, hooded		Japan, U.S.S.R		E 1	15	NA	NA

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	Species	1		1		r ———	·
Common name	Scientific name	Historic range	Vertebrate population where endangered or threatened	Sta- tus	When <b>isted</b>	Critical habitat	Special rules
Finch, Laysan (honeycreeper)	Telespyza ( = Psittrostra) cantans	1100		<del></del>		ļ	
Finch, Ninoa (honeycreeper)	Telespyza ( = Psitirostra) cantans Telespyza ( = Psitirostra) uluma		Entire	ا ہا	_	1	
Flycalcher, Euler's	Empidonex euleri johnstonei	······································		E	1	] NA	NA
Plycelcher, Sevenelles neredice	Tamaint	······· West Indies: Grenade	***************************************	E	1	NA	N
PMCBICHAY, FAMILIA		······i Mass Ocean Sevebelles		E	3	NA	NA
POOV. Severales (meaner final)					3	NA	NA
PROBIODITO, Androw's	F				3	NA	NA
G0000, Aleulian Canada	Oneste			E	3	NA	NA
(20000, Hawaiian (= nana)	Alexander de la contraction de				15	NA	NA NA
GOSPANIK Christmas leteral	A			E	1. 3	NA	NA NA
Grackle, slender-billed	Accipiter lascialus nelalis	Indian Ocean: Christmas Island		E	1	NA	NA NA
Grasswan Furan (throatches)	Quisicatis (= Cassidir) palustris	Marico	·· ··· <b>do</b>	Εİ	3	NA I	NA NA
Grebe, Alitian	Amytomis govderi	A	·do	Εİ	3 /	NA I	NA NA
Greenshank, Nordmann's	····  FULBYIEUUS GIGGE	C	·· <b>do</b>	Εĺ	3 1	NA NA	
Comment, resembles	Tringe guttiler			Ē	3	NA	NA
Gues barned		Down output, sould to Malaya,	do	Ē	15	NA NA	NA
Guan, horned	Oreophesis derbianus			-	.5	MA	NA
Gull, Audouin's	Larva audovinii .	After all a	do	ΕÌ	3		
Gull, relici	Lane relicus			ĒΪ		NA	NA
THE ANOUGH ISLAND SPACEOU	Anainin A			Ē	3	NA	NA
19MK, Galegeggs	Outro catan			Ē	15	NA	NA
lawk, Hawaiian (= 10)	Auton antique				3	NA	NA
MINE DOOK-billed (humminghird)	01			E	3	NA	NA
OneyCreener, crested (= 'ekohekohek	Glaucis (=Ramphodon) dohrnii			E	1	NA	NA
lornbill, helmeted	Palmeria dolei			E	15	NA	NA
oneyester, helmeted	Fithinoplex vigil	Theiland, Malaysia		E	1	NA	NA
ois, Japanese crested	MOETIAGA CASSINI	Acceptant :	<b>do</b>	Εj	15	NA	NA.
	] Mipponie nippon	Chipa I 1100	<b>do</b>	Εİ	4	NA	NA NA
	] PENMOCHAIDE LIDANIE	Court David Court, Holds	<b>do</b>	Εİ	3	NA I	NA NA
akapo (=qwi-parrot)	Stripops habronitus	Many 7	<b>do</b>	E	3	NA I	NA NA
estrel, Mauritius	. Paco ouncielus	4-40	do	Εİ	3	NA	
estrel, Søychelles	. Palco arage	today Court Mauricus		Ē	3	NA I	NA
nglisher, Guern Micronesian	. MICHOR CORRESPONDE CORRESPONDE	white Ocean Seycheses Islands		Ē	3		NA
te, Cube hook-billed	Chondrohierax uncinalus wilsonii			Ē	156	NA	NA
te, Grenade hook-billed	Chondrohierax uncinatus mirus		- A- I	Ē	3	NA	NA
10, Everalado anail	Rosehemus sociabilis plumbeus	··· TYPE BEEN LEADING		ĒΪ	3	NA	NA
okako (wattiebird)	Callagas cinerga.	U.O.A. (FL)	- A- 1	Ē	7.1	NA	NA
BCBW, giaucous	Anndorhunchus oleumus	New Zeeland	do	Ē		17.95(Ы)	NA
BCBW, indigo	Anadartanatus (sacis	······································	- Ala	Ē	3	NA J	NA
scaw, little blue	Anodorhynchus leari	·   CT   22 · · · · · ·			15	NA	NA
agpie robin, Seychelles (thrush)	Cyanopaitta specii		<u> </u>	E	15	NA	NA
alkaha, red-laced (cuckoo)	Copsychus sachellarum			E	15	NA	NA
Mariana	Phaenicophaeus pyrrhocaphaius		- An	Ε	3	NA	NA
	Anas austaloš	West Pacific Ocean: U.S.A. (Guarn,	<b>G</b>	Ε	3	NA	NA
Pgapode, Micronesian (=La Per-		Mariana Islanda).	1	E	23	NA	NA
Oute's). Igapode, Maleo	Macrocephalon maleo	West Pacific Ocean: U.S.A. (Palau lelend, Mariana Islands).		E	3	NA	NA
lerbird, Nihoa (old world warbler)	ACTOCOCHENE femiliaris kingi	ILO A AM	do	E	3	NA	1
onarch, Tinian (old world Mycatcher)	Monarcha takatsukasao	Works 9	do	E	11	NA	NA
orhen (=gellinule), Hewaiian		telande).	<b>do</b>	E	<b>3</b>	NA	NA NA
Common.	Gallinula chloropus sandvicensis	U.S.A. (Hi)	ا	٦ ا	. [	- 1	- 1
	Calling to the		3	E	1	NA	NA
·	Gallinule chloropus guami	Western Pacific Ocean: U.S.A. (Guarn, Tinian, Saipan, Pagan).	do	E	156	NA	NA
htjar (=whip-poor-will), Puerto Rico	Canomulaus noctuborus	U.S.A. (PR)	1	1			

	Species		Vertebrate			7	1
Common name	Scientific name	Historic range	population where endangered or threatened	Sta- tus	When listed	Critical habitat	Special fules
Pheasant, white eared		China (Tibat) 4-4				<del> </del>	<b> </b>
Pigeon, Azores wood	Cohumba nakumbun anasas	China (Tibel), India	do	Ε	4	1	i
Pigeon, Chatham Island	Hemiphaga novaeseelandiae chathan	CESI AUBRUC UCAAN: Azorea	- A-	Ē	•	NA.	l N/
	ancie Cigulati	New Zealand	do	- 1	3		N
Pigeon, Mindoro zone-tailed		ľ		E	3	NA	N/
Pigeon, Puerto Rican plain			ا مما	_ [		1	Ì
Piping-guan, black-fronted		U.S.A. (PR)		E	15	NA.	l N
Diffe Nochie				E	2	l NA	N.
Pilla, Koch's	Pitta kochi	DANIi		Εİ	15	NA.	N
Plover, New Zealand shore	Thinomis novaeseelendee	New Zooland		E	15	NA.	N
Plover, piping	Cheredrius melodus		<b>do</b>	Ē	3	NA NA	
<i>:</i>		U.S.A. (Great Lakes, northern Great Plains, Atlantic and Gulf Coasts, PR, VI), Canada, Mexico, Bahamas, West Indies.	Great Lakes watershed in States of IL, IN, MI, MN, NY, OH, PA, and WI	Ē	211	, ñá	N
Do	do		and Province of Ontario	ľ			
		do	Entire, except	7	244	l l	
la'asti (hanassa			those areas where listed as endangered	'	211	NA	NA
o'ouli (honeycreeper)	Melamprosops phaeosoma	U.S.A. (HI)	above.				
rairie-chicken, Attwater's greater	Transportation avaids as		<b>do</b>	E	10	NA	NA
hail, Merriem's Montezume	Odlome meeten mee		<b>do</b>	E	1	NA	NA NA
lueizel, respiendent	Charamachara masina		do	E	15	NA	
eil, Aukland Island		- I MUNICO IO PANAMA	ا ملم	Ē	15		NA
ail, California clapper		New Zeeland	do l	Ē	3	NA	NA
eil, Guern	Railus longirostris obsoletus	U.S.A. (CA)	do	Ē	- 1	NA	NA
	Railus owstoni	Western Pacific Ocean: U.S.A. (Guam)			2	NA	NA
ail liabs to see a		1		E	146E,	NA	NA
ail, light-looted clapper		U.S.A. (CA), Mexico (Beja Caldornia)		ļ	156	i	
eil, Lord Howe wood	Tricholimnas sylvastus	Australia (Land Marin Artis II)	do	E	2	NA I	NA
ail, Yurna clapper	Rathe topoiroctric anamonomous		<b>do</b>	E	15	NA	NA
hea, Darwin's	Pletocoemia pagnata	I MOACO, U.S.A. (AZ (.A)	المام	Εİ	1	NA	NA NA
obin, Chatham Island	Petroica traversi	Argentina, Bolivia, Pani, Uninuav	امهما	Ε	3	NA	
obin, scarlet-breasted (flycatcher)		rvew Zealand	do l	Ē	3		NA
Ocklowi oray-necked	Petroica multicolor multicolor	MUNICIPAL (MORIOR Island)	de i	Ē	3	NA	NA
ocklowl, white-necked	Picathartes oreas				3	NA	NA
Mar long toiled asset		I AIRCE: 1000 to Sierre Leone	ala I	E	3	NA	NA
oller, long-tailed ground	. Uratelornis chimaera	Melagasy Republic ( Medegascar)		E	3 ]	NA	NA
zuo-oira, noisy	Atrichomis clamosus	Australia	<b>GO</b>	E	3	NA .	NA
	Coosychus niner cehvensis	Australia	<b>do</b>	E	3	NA	NA
learwater, Newell's Townsend's (for- merty Manx) (= 'A'o).	Pullinus auriculans (formerly pullinus)	Philippines U.S.A. (HI)	do	E	3	NA NA	NA NA
rike, San Clemente loggerhead	Lanus kudovicianus mearnsi	U.S.A. (CA)	1	1		1	1971
kin, red	Carduelis (= Spinus) cucullata		do	Ε	26	NA	
errow, Cape Sable seaside	Ammodramus (= Ammospiza) maris	South America	do	Ē	15	NA I	NA
•	mus mirabilis	U.S.A. (FL)	do	Ē		17 95(b)	NA NA
arrow, dusky seaside	Ammodramus (=Ammospiza) mariti-	do	4.	_	!	1	ľ
	MUS MOYOSCONS			E	1   1	17 95(b)	NA
arrow, San Clemente sage		1164 (64)	1	ĺ	[	,-,	
rling, Ponape mountain	Aplonis pelzelni	U.S.A. (CA)	do	T	26	NA	NA
· · · · · · · · · · · · · · · · · · ·		WORL PRODE Ocean: IISA (Carolina )	do	Ε	3	NA NA	
vlina. Rothschild's (mina)		ralanda).	i	-	٦	mA	NA
t Managar / Astro		Indonesia (Bali)	do l	E	3	NA	
		U.S.A. (HI)					NA I

	•
-	•

Sp	ecies	Historic range	Vertebrate population where	Sta	When	Critical	Special
Common name	Scientific name	I statut to read	endangered or threatened	we	listed	habitat	rules
Stork, oriental white	Ciconia ciconia boyciana	China, Japan, Korea, U.S.S.R	do	E	3	NA	NA
itork, wood	Adycteria americana	U.S.A., (CA, AZ, TX, to Carolinas), Mexico, Central and South America.	U.S.A. (AL, FL, GA, SC).	E	142	NA	NA
wittlet, Vanikoro	Aerodramus (= Collocalia) vanikorensis	Western Pacific Ocean: U.S.A. (Guarn, Rote, Tinian, Saipan, Agiguan).	Entire	E	156	NA	NA
	bertschi.	New Zealand (Campbell Island)	do	E	15	NA.	l N
el, Campbell Island flightless	Anas aucklandica nesiolis	Mexico, U.S.A. (CA)	do	Ē	2. 3	NA.	l N
orn, California least	Sterna antillarum ( = albifrons) browni	U.S.A. (Atlantic and Gulf coasts, Miss.	U.S.A. (AR, CO,	Ē	182	NA.	N
ern, least	Stema antillarum	R. Basin, CA), Gr. and Lesser Antilles, Bahamas, Mexico; winters C. Amer- ica, northern S. America.	IA, IL, IN, KS, KY, LA (Miss. R. and tribs. N of Baton Rouge), MS (Miss. R.), MO, MT, NE, NM, ND, OK, SD, TN, TX (Except within 50 miles of coast) J.				
		West Indies: St. Lucia, Martinique	Entire	E	3	l NA	N/
rasher, while-breasted	Remphocinclus brachyurus	U.S.A. (H)	do	Ē	2	NA.	N/
nuch, large Kausi	Myedestes (=Phaeomis) myadestinus	U.S.A. (Fil)do		Ē	2	NA.	l N
hrush, Molokai (=oloma'o)	Alyadestes (=Phaeomis) lanaiensis			-	1 -	1	1
	(=obecurus) ruins.	New Zealand	do	. E	3	NA.	l N
hrush, New Zealand (wattlebird)	Turnegra capensis	U.S.A. (HI)		Ē	1 1	NA.	l N
hrush, small Kausi (=pusiohi)	Myadestes ( = Phaeomis) palmeri	Brazil, Paraguay, Argentina			15	NA.	N
inamou, solitary	Tinemus sokierus	West Indies: Martirique		] Ē	3	NA.	N
rembler, Martinique (thrasher)	Cinclocerthia rulicauda gutturalis	Australia	do		l 6	NA.	N
(collared-hemipode)	Pedionomous torquatus	U.S.A.(Southeastern), Cuba		-	1, 3	NA.	l N
larbler (wood), Bachman's	Vermivore bechmeni	West Indies: Barbados	do	ĪĒ	1 3	NA.	l N
terbler (wood), Barbados yellow	Dendroica pelechia pelechia	West Indies: Earbados	do	ΙĒ	1.3	NA.	l n
Varbler (wood), Kirtland's	1	U.S.A. (principally MI), Canada, West Indies: Baharna Islands.		E	3.4	NA.	N
Varbler (willow), nightingale reed	Acrocephalus luscinia	Western Pacific Ocean	U.S.A. (Malasia	-	1	1	'
(MESO), 1-\$-12-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-5-				ΙE	3	NA.	l N
Varbier (willow), Rodrigues	Bebrornis rodericanus	Mauritius (Rodrigues Islands)	1		3	NA.	N.
Varbier (wood), Semper's	Leucopeza semperi	West Indies: St. Lucie			3	NA.	N
fartier (willow), Seychelles	Bebromis sechellensis	Indian Ocean: Seychelles Island	N .	Ē	] 3	NA.	l N
Whichird. Western	Pagghodes nigrogularis	Australia		Ē	156	NA.	l ñ
White eye, bridled	Zosternos conspicifista conspicifista	Western Pacific Ocean: U.S.A. (Guern)		Ē	15	l NA	l N
Ville eye, Norick Island		Indian Ocean: Norfolk Islands	<b>do</b>	E	3		l n
Ville-eye, Ponepe greater		West Pacific Ocean: U.S.A. (Caroline Islands).	j	[	3	NA NA	"
Ante Courballon	Zosterope modesta	Indian Ocean: Seychelies	<b>do</b>		1 -	NA NA	N
White eye, Seychelles		Madeo	<b>do</b>	. E	3		
Moodpecker, imperial		U.S.A. (southcentral and southeastern), Cuba.	<b>do</b>	. E	1, 3	ì	N
	Picoides ( = Dendrocopos) boreaks	. U.S.A. (southcentral and southeastern)	do	. E	2		N
Woodpecker, red-cockeded		Korea	<b>do</b>	. E	3	NA.	1
Woodpecker, Tristem's		West Indies: Guadeloupe	do	E	3		N.
Wren, Guadeloupe house Wren, St. Lucia house	Troglodyles aedon mesoleucus	West Indies: St. Lucia	do	E	1 3	NA.	l N

<u> </u>			Vertebrate	1	]		
Common name	Scientific name	Historic range	population where endangered or threatened	Sta- tus	When <b>liste</b> d	Critical habitat	Special rules
REPTHES	1			<del>                                     </del>	<del> </del>		ļ
Alligator, American	4Minutes			1	1	ľ	ł
	Altigator mississippiensis	Southeastern U.S.A	1,000		1	1	ł
	1			E	1, 11, 51,	. I NA	l N
	1		in wild except		60, 113		l "`
	<b>]</b>		those areas	1	134	i I	l
	1		where listed as	ſ			i
Ωο	Ĭ	i	threatened as	í .	l	1	
Do	<b>do</b>	l do	set forth below.	i .	1	j	1
			U.S.A. (FL and	T	20, 47,	NA	
			certain areas of	1 1		, ,-,	17.42(
•	· ·		GA and SC, as	<u> </u>	51, 60, 134		
		1	set forth in	1 1	00, 134	1 1	
Do	do		47 464 444	l l		1 1	
	do	<b>do</b>	U.S.A. (LA and	الميصيا		Į	
	· I		TX).	T(S/A)	11, 47,	NA	17.42(8
	1	1	14).	1	51,	1 [	,
Ωα	1 .	1	[	1 1	60, 113,	1 1	l
Do	<b>do</b>	<b>do</b>	1	1 1	134	1 1	
Minntne Chinana	1	l control of the cont		T(S/A)	11, 47,51	NA	17.42(a
Aligator, Chinese	Alligator sinensis	China	wherever found	Ì	-	''	
Incle, Culebra taland giant	Anolis rocesuelii	11 C A 100. C	Entire	E	15	l na l	N/
loe, Jameican	- CPICIBIOS BUDGIONUS	lamaine.	do	E	25	17.95(c)	NA NA
los, Mons.	. Epicrales monensis monensis	11 Q A /DO)	do	Εl	3	NA	
loe, Puerto Rico:	. Epicrales inometus		ا ملسا	T	33	17.95(c)	NA
<b>00. Hound Island (no common name)</b>	Casarea dussumieri	******	I		2	NA NA	NA
OB. Hound Island (no common name)	Bolyeria multocarinata		1 44 1	Ē	88	I NA	NA
OG, Virgin Islanda tree	Epicrates monensis granti	******	1 4- 1	Ē	88	NA I	NA
alman, Apaporia River	Caiman crocodilus apaponensis	······ C.C. SIU CHEMI VECIN ISLANIE	ا ماسا	Ē	2. 86	1	NA
eimen, black	Melanosuchus niger		ا ماسا	Ē	15	NA I	NA
All Rent broad-enoused	Caiman latinostris	·····   /WINDOWS DREAT	ا مفعا	Ē	15	NA	NA
aiman, Yacare	Coinen concedit	·····   UP CASE AND THE PARTIES   Insuran	I 444 I	ĒΙ		NA	NA
huckwalla, San Esteban Island	Caiman crocoditus yacare	····· Curre. / Current E. Francis (Marie	1 44 1	Ē	15	NA	NA
rocodile, African dwarf	Sauromakie varius	····   ••••••••••••••••••••••••••••••••	1 444 1		3	NA	NA
rocodile, African elender-enouted	Osteolaemus tetraspis tetraspis	···· · · · · · · · · · · · · · · · · ·	1 4-	E	88	NA	NA
rocodile, American	Crocodylus cataphractus	····· Type II are Cereal Abrea	1 4 1	E	15	NA	NA
	Crocodykus acukus	U.S.A. (FL), Mexico, South America,	4-	E	5	NA	NA
romatile Coules and		Control American Co. 114		E	10, 87	17.95(c)	NA
ocodile, Ceylon mugger	Crocodylus palustris tumbula	Sri Lanka	1				
ocodile, Congo dwarf	Ostociaamus latrasnis nehovni	Cases Ot d	do	E	15	NA	NA
ocodile, Cuben	Crocodylus rhombiler	0.4	• • • • • • • • • • • • • • • • • • • •	Ε	15	NA	NA
ocodile, Morelet's	CFOCOONEUS moreleis	Marian Dallan O	<b></b>	E	3	NA	NA
ocodile, mugger	CTOCOONES Debushie pakushie	India Debiates Inc. Co. 4 4	do	E	3	NA I	NA.
ocodile. Nile	CTOCOOMENS Milaticus	Africa	الحاما	Εļ	15	NA	NA NA
ocodile, Orinoco	Crocodytus intermedius	ARGO	ا مدما	E	3	NA I	NA NA
ocodie, Philippine	Crocodykis novasguinase mindorensis.	SULEI AMERICA: Unnoco River Basin	do	Ē	3	NA I	NA NA
	Crocoditie porceus			Ĕ	15	NA	
		Southeast Asia, Australia, Papua-New	Entire, except	Ē	87	NA	NA
1		Guinea, Pacific Islands.	Papua-New	-	٠,	144	NA
ocodile, Siernese	Consodidate sismansis	ì I	Guinea.		1	1	
	Crocodykus siamensis	Southeast Asia, Maley Peninsula	Entire	E	15	]	
	Gavialis gangeticus	Pakislan, Burma, Bandladesh, India (	40	Ē	3, 15	NA	NA
cko, day	Photours and a	Nepal.		-	J, 13	NA	NA
cko, Monito	Phelsuma edwardnewtoni	Indian Ocean: Mauritius	do	E	_ ا		
	Sphaerodectylus micropithecus	U.S.A. (PR)	do		3	NA	NA
			do	E		17.95(c)	NA
LEG CHIMINI INIMINI	Charles and Assessment and Assessmen		483	P- 1	3	NA I	NA

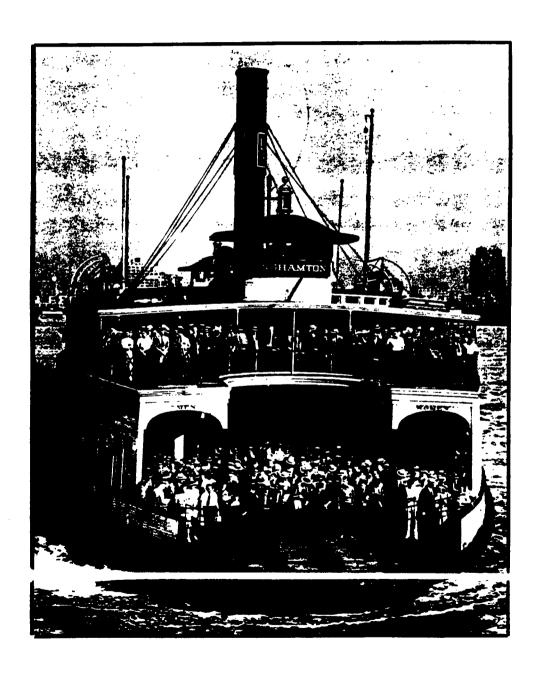
	pecies		Vertebrate population where				
Common name	Scientific name	Historic range	endangered or threelened	Sta- tus	When <b>heled</b>	Critical habitat	Speci
guana, Acklins ground			do	Т	129		
juana, Allen's Cay		<b>do</b>	do	Ť	129	NA	
uana, Andros Island ground			4-	Ŧ		NA NA	
uene, Anegede ground	Cyclure pinguis	West Indies: British Virgin Islands (Ane-	do	É	129 3	NA NA	
vana, Barrington land		Ecuador (Galepagos Islands)	do l		_		ŀ
uene, Cayman Brac ground	Occlure nubile covmenensis	West Indies: Cayman Islands		E	3	NA	
vene, Cuben ground	Cyclure nubile nubile	Cube	Entire (excluding	Ţ	129	NA	
			population introduced in		129	NA	
ene, Exume Island		West Indies: Bahamas	Entire	т	120		
ene, Fiji bended		Pacific: Fili, Tonga	الما	Ė	129 88	NA	
ana, Fiji crested	Brachylophus vitieneis	Pacific: Fili	اداما	ĒΙ	88	NA	
ene, Grand Cayman ground		West Indies: Cayman Islands	اداءا	Ē		NA	
ene, Jemaicen	Cyclure collei	West Indies: Jemeics	40		129	NA	
ene, Mayaguene	Cichira carinete bertechi	West Indice: Rehemes		Ē	129	NA	
ene, Mone ground	Cyclure stejnegeri	U.S.A. (PR: Mone Island)	20	Ţ	129	NA	
ana, Turks and Caicos	Cyclure cerinete cerinete	West Indies: Turks and Caicos Islands		Ţ	33	17.95(c)	
ena, Walling Island ground	Cyclure rileyi rileyi				129	NA	
ana, White Cay ground	Cychira rileyi cristala		40	E	129	NA	
rd, blunt-nosed leopard	Gambelia (= Crotephytus) silus		<b>do</b>	7	129	NA	
rd, Coachella Valley fringe-toed	Companyles Siles		do	E	1	NA	
rd, Hiero giant	Ume inornete	do	do	T	105	17.95(c)	
	Gallotia simonyi simonyi		do	ΕÌ	144	NA	
ard, fbiza well	Podercie pityusensis		do	Ť	144	NA I	
ard, leland night	Xantusia (= Klaubenna) riversiana	U.S.A. (CA)	do	Ť	26	NA I	
ard, St. Croix ground		U.S.A. (VI)	do	ĒΪ	24	17.95(c)	
nitor, Bengal	Varanue bengalensis	Iran, Iraq, India, Sri Lanka, Malaysia, Alghanistan, Burma, Vietnam, Thai-	<b>do</b>	Ē	15	NA	
nitor, desert	Varanus grisaus	lend.		_ [	l l	ı	
		through U.S.S.R. to Pakistan, North- west India.	do.:	E	15	NA	
nitor, Komodo Island	Varanus komodoensis		do	E	15	NA	
nitor, yellow	14	western Flores Island).	ľ	- 1	1		
• •	. Varanus itavescens	desh.	40	E	15	NA	
non, Indian	. Python molurus molurus		do	Εļ	15	NA Ì	
	. Crotalus unicolor		do	T	129	NA	
licenake, New Mexican ridge-nosed			<b>do</b>	T	43	17.95(c)	1
nk, Round leland	Leiolopisma tellari		60	T	129	NA	ï
nko, Atlantic salt marsh	. Nerodia lasciala taeniala		do	T	30	NA	i
ike, eastern indigo	Orymarchon corais couperi		do	ΤÍ	32	NA	i
ke, San Francisco garter	Themnophis sirtalis tetralaenia		<b>do</b>	Ε	1	NA	į
lange	Podocnemis expense	South America: Orinoco and Amezon River basins.	40	E	3	NA	,
rapin, river (= Tunlong)	Balagur baska	donesia	<b>do</b>	E	3	NA	•
nisloma	Tomistoma schlegelu		do	E	15	NA	N
rloise, angulated	Geochelone yniphora	Malagasy Recubiic ( Medegascer)	do	Ε	15	NA	N
toise, Bolson	Gopherus flavornarginatus	Mexico	do	E	46	NA	Ñ
loise, desert	Scaptochetys (= Gootherus) agassize	U.S.A. (UT. AZ, CA. NV): Mexico	Beaver Dam	_ 1	103	17 85tci	Ä

NUS CORPORATION AND S	UBSIDIARIES	TELECON NOTE
CONTROL NO:	DATE:	TIME:
02-8804-02	2-16-89	0930
Info. on Anth	oun Kill, Manitian Bay, and	The Rahway River.
BETWEEN:  M. Dellemo  AND:	OF: , O, 0	PHONE: (201) 634-4500 ex.207
G. A. Calab	ye.	
DISCUSSION:		g is permitted
in the arthur	hill. Mr. Dellon	o noted that
there is a high	Mercury content in	the arthur.
Kill. I ishing is	permitted but	they (people Rishing)
are told that	eating the fish	s at the
m- O. a.a. ' K	according to	the best of
1102. Dellamos Kn	owledge no recrea	itional purposes
uver Tohe Ran	in The a. K is	likely Ha
same as well as t	he Rahwas River and	the tributaries
of the anthur Kil	L.	
ACTION ITEMS:		
	,	



# New Jersey & National Registers of Historic Places

as of December 31, 1984



Office of New Jersey Heritage

## STATE OF NEW JERSEY

THOMAS H. KEAN, GOVERNOR

## DEPARTMENT OF ENVIRONMENTAL PROTECTION

ROBERT E. HUGHEY, COMMISSIONER

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cover: Ferryboat Binghamton,

Edgewater Borough, Bergen County

NEW JERSEY & NATIONAL REGISTERS OF HISTORIC PLACES

AS OF DECEMBER 31, 1984

OFFICE OF NEW JERSEY HERITAGE
DIVISION OF PARKS AND FORESTRY
DEPARTMENT OF ENVIRONMENTAL PROTECTION

CN 404

TRENTON, NEW JERSEY 08625

#### ORGANISMS TERRESTRIAL

Shown in BROWN; species with special status shown in RED(F) or (S) indicates species protected by Federal or State Legislation (see text)

#### SYMBOL

SPECIES

PLANTS (301-350)

```
Eastern hemlock
Spleenwort (S)
Spider fily (S)
Pond bush (S)
           Watermilfoil
                              (S)
           Hooded pitcher plant (S)
Tree
           Prickly pear cactus (S)
Trailing arbutus (S)
Eastern bumelia
Pitcher plant
            Baidcypress
            Redbay
Seaside alder
Box huckleberry
            Purple tringeless orchid
Pink jady's slipper
            Epony spleenwort (S)
Orchids (S)
            Gorden crub (Si
             East-coast coontie
Fall-flowering ixia
             Jackson-vine
            Spoon-flower
             Curtiss milkweed
             Sea lavender
     328
329
330
331
             Needle palm
             Yellow squirrel-banana
             Beach creeper
             Florida coontie
             Four-petal pawpaw
     334
335
336
337
             Bird's nest spieenwort
             Burrowing tour-o'clock
             Beach star
Silver palm
             Dancing lady orchid
Tamaringillo
      340
             Fuch's bromeliad
             Everplades peperomia
     342
343
             Buccaneer palm
Slender spieenwort
              Pineland jacquemontia
             Mahogany mistietoe
Florida thatch
              Twisted air plant
              Long s bittercress
      349 Venus's flytrap
INVERTEBRATES (351-400)
      351 Monarch butterfly
352 Zebra butterfly
BIRDS (401-600)
      SHOREBIRDS (401-430)
            401 Shorebirds
402 Terns
403 Gulls
            404
405
                   Forster's tern
Arctic tern
            406
407
                    Least tern (S)
                    Roseate tern (S)
            408
409
                    Common tern
                    Great black-backed gull
                    Herring guil
                    Laughing gull
Black skimmer (S)
```

## Newark

N. J.-N. Y.-PA.

69-805- -**GE®STAT** 

1:250 000-scale map of Atlantic Coast **Ecological Inventory** 





Produced by U. S. FISH AND WILDLII **SERVICE** 1980

#### **ORGANISMS** AQUATIC

Shown in BLUE: species with special status shown in RED(F) or (S) indicates species protected by Federal or State Legislation (see text)

SYMBOL

**SPECIES** 

PLANTS (1-50)

1 trish moss 2 Rockweed

INVERTEBRATES (51-100) 51 Crabs 52 Mussels 53 Oysters

Louisiana heron (S) Limpkin (S)

Limpkin (S)
Roseate spoonbill (S)
Snowy egret (S)
Magnificent frigate-bird (S)
Reddish egret (S)
Clapper rail

431 432 433 434 435 Herons Egrets Rails

436 437

440

Yellow-crowned night heron (S)
Black-crowned night heron
Florida sandhill crane (S)

Turnstones Plovers Piping plover American oystercatcher (S) 416 WADING BIRDS (431-460)

411

Great blue heron (S)
Wood ibis (S)
Anhinga
Little blue heron (S) 438

Wading birds

Ibises Bitterns

